Phase I Remedial Investigation
Pasco Landfill
Pasco, Washington

Volume I - Work Plan

November 1992

Prepared for:

Pasco Landfill PLP Group

Project 624419

Prepared by:

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ABSTRACT

The Phase I Remedial Investigation Work Plan for the Pasco Landfill in Pasco, Washington describes the various steps or phases essential to the investigation process and defines the activities that will be conducted during this investigation. This Phase I Remedial Investigation will be completed under an Agreed Order with the Washington Department of Ecology (Order No. DE92TC-E105) and in compliance with the Model Toxics Control Act (Chapter 70.105D RCW and Chapter 173-340 WAC). Because the Pasco Landfill site is on the National Priority List, the Phase I Remedial Investigation will also be conducted in a manner consistent with the National Contingency Plan (40 CFR Part 300).

The objective of this investigation is to gain additional information on the nature and extent of contamination in the air, soil, and groundwater near potential contaminant sources at the Pasco Landfill. A Preliminary Risk Assessment will also be completed. This Work Plan describes the various steps proposed for gathering the necessary site characterization information and data and for performing the Preliminary Risk Assessment.

As part of the Work Plan (Volume I), a Sampling and Analysis Plan (Volume II), a Data Management Plan (Volume III), a Health and Safety Plan (Volume IV), and a Public Participation Plan (Volume V) have been developed for the performance of this project. Completion of the work defined in these planning documents will be followed by a Phase II Remedial Investigation (if necessary) and a Feasibility Study. The Washington Department of Ecology will ascertain the need for additional remedial investigation activities and the scope of the Feasibility Study based on the findings from the Phase I Remedial Investigation. Following the Feasibility Study, any need for remedial action will be determined by the Washington Department of Ecology.

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EXECUTIVE SUMMARY

This Phase I Remedial Investigation (RI) Work Plan has been prepared for the Pasco Landfill Potentially Liable Party (PLP) Group, which is comprised of 29 parties. This project is being completed under an Agreed Order with the Washington Department of Ecology (Ecology) in compliance with the Model Toxics Control Act (MTCA) (Chapter 70.105D RCW and Chapter 173-340 WAC).

This Work Plan is accompanied by a Sampling and Analysis Plan (SAP), Health and Safety Plan (HASP), Data Management Plan (DMP) and a Public Participation Plan (PPP). These five plans constitute the complete Work Plan package for the Pasco Landfill Phase I RI. The work described in these documents is intended to conform with MTCA regulations and is consistent with the National Contingency Plan (NCP) and pertinent U.S. Environmental Protection Agency (USEPA) guidance documents.

This Work Plan consists of the following five major elements:

- introduction;
- site background;
- Preliminary Conceptual Site Model;
- Work Plan rationale; and
- Phase I RI tasks.

The specific activities proposed by the PLP Group are presented in Chapter 5 and in the accompanying planning documents. These activities are divided into seven separate elements:

- Project Planning;
- Community Relations;
- Field Investigation;
- Sample Analysis/Validation;
- Data Evaluation;
- Preliminary Risk Assessment; and
- Reporting.

The objective of this Phase I RI is to gain additional information on the nature and extent of contamination in the air, soil, and groundwater near potential contaminant sources at the Pasco Landfill. A Preliminary Risk Assessment will also be completed to gain an understanding of the potential risks associated with the contaminant sources present at the Pasco Landfill. This Work Plan describes the various steps necessary for gathering the site characterization information and data and for performing the Preliminary Risk Assessment.

This Work Plan and the accompanying documents are designed to be flexible because field conditions may dictate various changes in scope or procedure. Significant changes will be presented to Ecology for concurrence prior to implementation.

1 INTRODUCTION

This Phase I Remedial Investigation (RI) Work Plan for the Pasco Landfill was prepared for the Potentially Liable Party (PLP) Group by Burlington Environmental Inc. (Burlington). The Work Plan development process began with Project Scoping, which included:

- existing data review and analysis; and
- development of a Preliminary Conceptual Site Model (PCSM) addressing:
  - population and environmental concerns at risk;
  - exposure pathways;
  - hazardous properties, environmental fate, and form of potential contaminants of concern;
  - hydrogeologic framework;
  - climatic factors;
  - source identification;
  - preliminary identification of Applicable or Relevant and Appropriate Requirements (ARARs); and
  - preliminary identification of remedial action objectives and alternatives.

The existing data review and analysis and the resulting PCSM were used in formulating the Work Plan (Volume I) and other planning documents, that include the Sampling and Analysis Plan (Volume II), Data Management Plan (Volume III), Health and Safety Plan (Volume IV), and Public Participation Plan (Volume V). The PCSM findings are presented in Section 3.

1.1 Objectives of the Phase I RI Work Plan

The objectives of the Phase I RI Work Plan are to:

1. Define the Phase I RI activities proposed for this investigation.
2. When implemented, produce data that will aid in gaining a further understanding of the nature and extent of contamination in the air, soil, and groundwater near potential contaminant sources at the Pasco Landfill.
3. When implemented, complete a Preliminary Risk Assessment that will evaluate the potential risks to human health and the environment posed by the potential contaminant sources.
4. When implemented, define the need for any additional remedial investigations and the scope of the Feasibility Study.

1.2 Regulatory Authority

This investigation will be completed under an Agreed Order with the Washington State Department of Ecology (Ecology) (Order No. DE92TC-E105) in compliance with the Model Toxics Control Act (MTCA) (Chapter 70.105D RCW and Chapter 173-340 WAC). The investigation will also be consistent with the NCP as well as the approach outlined in the U.S. Environmental Protection Agency (USEPA) Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) guidance, including Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (USEPA 540/G-89/004, 1988) and Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites (USEPA 540/P-91/001, 1991a). Specific MTCA and CERCLA guidance used in the development of the various planning documents are listed in each document.

2 SITE BACKGROUND INFORMATION

This section summarizes the site background information gathered from various regulatory agency reports and other historical documentation. Geographic location and existing conditions are discussed as well as operational history, previous investigations, and site ranking. This information is considered preliminary and will be updated in the Phase I Remedial Investigation after a more comprehensive analysis of the site history is completed.

2.1 Geographic Location and Existing Conditions

The Pasco Sanitary Landfill is located approximately 1.5 miles northeast of the City of Pasco, Washington, in the southwest quarter of Section 15, and the northwest quarter of Section 22, Township 9 North, Range 30 East, Willamette Meridian, in Franklin County, Washington (See Figure 1). The landfill occupies a 250-acre site consisting of gently rolling hills surrounded by rangeland and irrigated cropland. The site is currently operated as a sanitary landfill and accepts municipal solid waste from the Benton, Franklin, Walla Walla, and Adams Counties. A permit application is pending before the Benton-Franklin Health District for a new, lined landfill cell on the northern-most portion of the site.

2.2 Site History

Table 1 summarizes the ownership and lease history of the Pasco Sanitary Landfill (shown on Figure 2). The parcel designations in Table 1 were assigned by Burlington and do not necessarily correspond to platted parcels. From the records reviewed, the exact locations of all parcels listed on Table 1 could not be fully established. Generally however, the following information is known. Parcels 1, 2 and 5 are the northwest quarter of Section 22. Parcels 3 and 4 are in the southwest quarter of Section 15. Parcel 6 is in the northeast quarter of Section 21.

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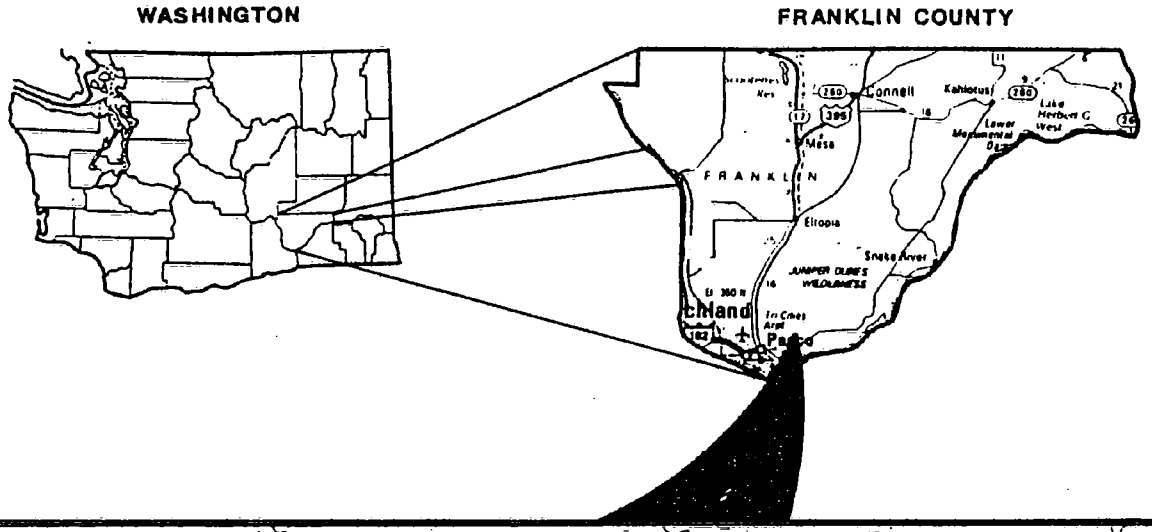

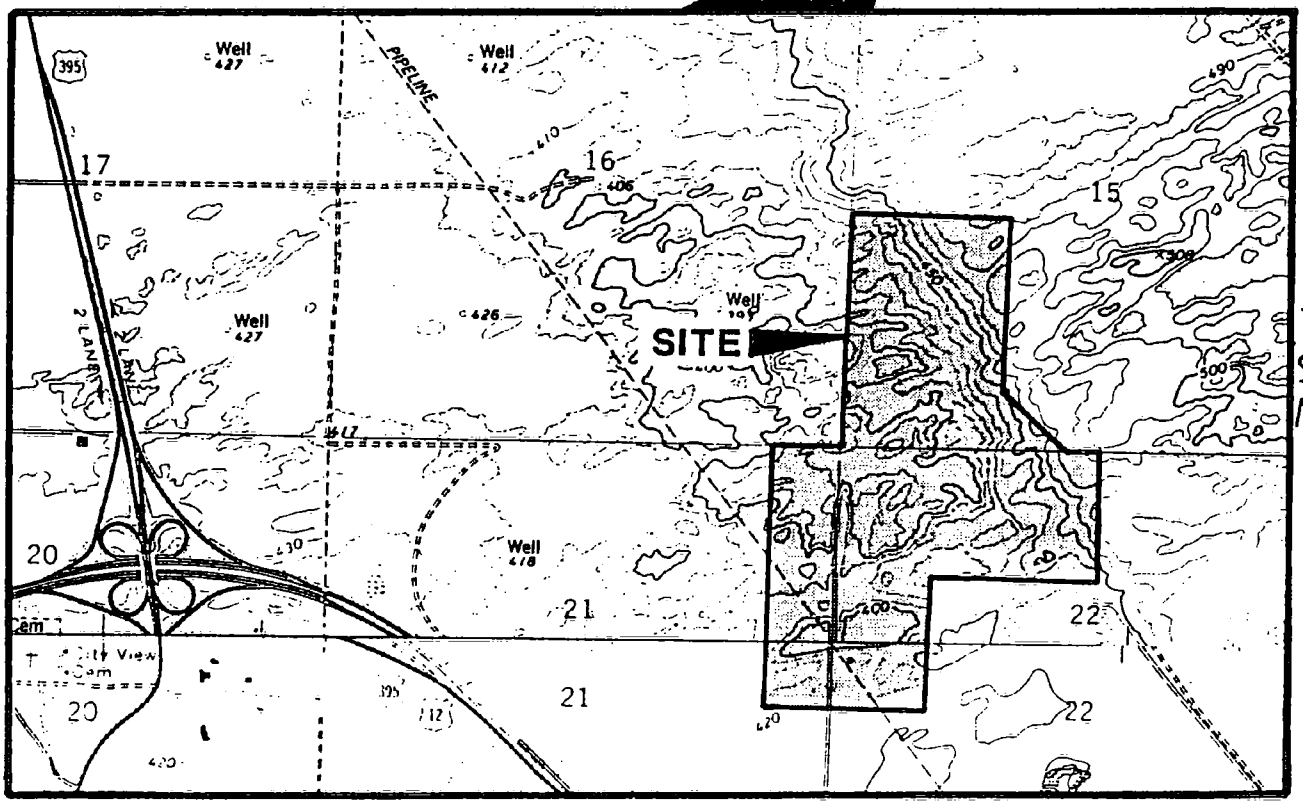

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Burlington Environmental Inc.

SITE LOCATION MAP

PASCO LANDFILL
PASCO, WASHINGTON
624419

FIGURE 1

Modified from U. S. Geological Survey Glade and Pasco, Washington quadrangle, photorevised 1973 and 1979.

Table 1

SUMMARY OF OWNERSHIP/LEASE HISTORY

PASCO LANDFILL
PASCO, WASHINGTON

PARCEL	SIZE (ACRES)	OWNER/OPERATOR	TIME
1	40	J. Dietrich/same dba Basin Disposal	1958-1971
		Leased to RRC	1973-1980
		Leased/Sold to Pasco Sanitary Landfill	1981-1992
2	40	Same as 1	Same as 1
3	40	BNRR/owner-lessor RRC/lessee	1973-1980
		PSL/lessee or owner	1981-1992
4	10	Same as 3	Same as 3
5	40	BLM/lessor RRC/lessee	1973-1980
		PSL lessee or owner	1981-1992
6	40	Columbia East Development	pre 1988
		L. Dietrich	1988-1992

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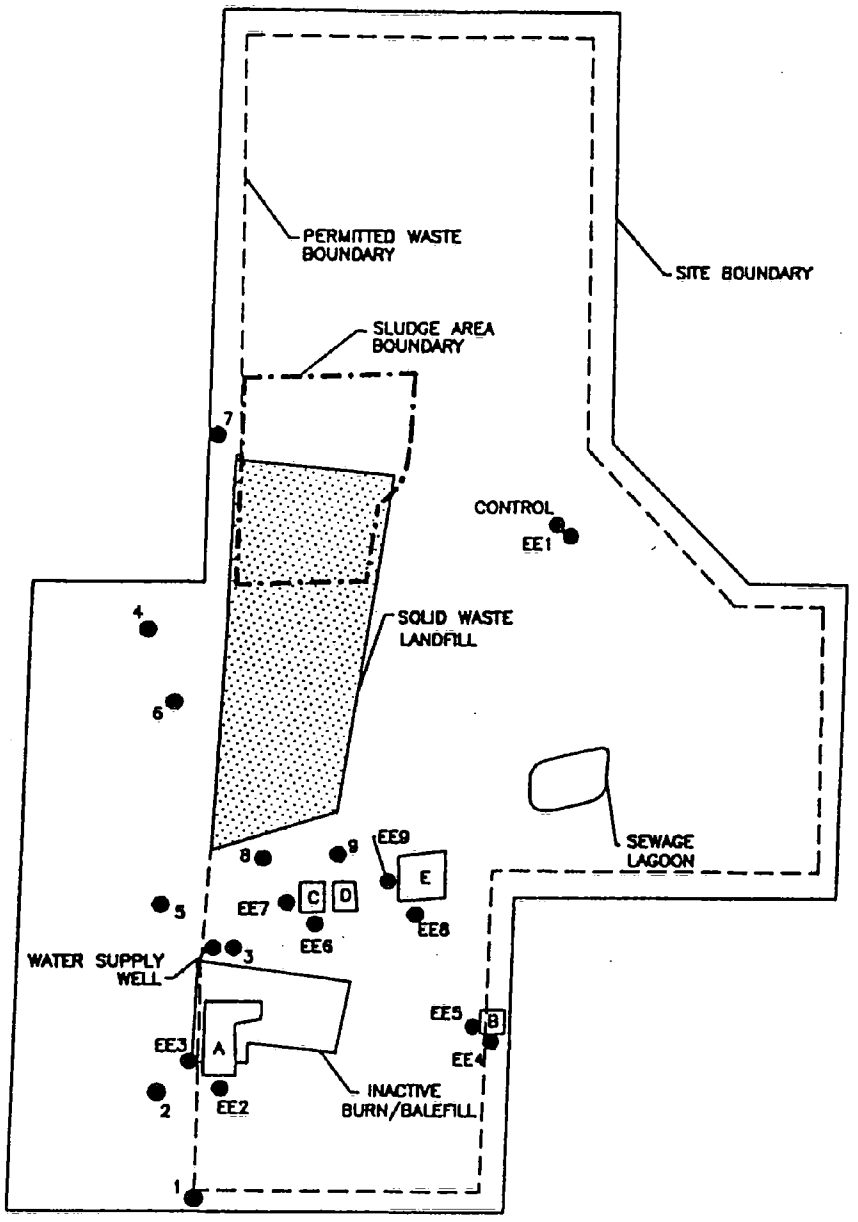

EXPLANATION

● EE2 WELL NUMBER AND APPROXIMATE LOCATION

0 800 1,600

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SITE PLAN

PASCO LANDFILL
PASCO, WASHINGTON
624419

FIGURE 2

Table 1 provides ownership history beginning in 1958 with the opening of the landfill. The various parcels have been owned by Mr. John Dietrich, Pasco Sanitary Landfill (PSL), Burlington Northern Railroad (BNRR), U.S. Bureau of Land Management (BLM), and Tomlinson Dairy. Lessees have included Resource Recovery Corporation (RRC) and Pasco Sanitary Landfill.

Throughout the site history, waste disposal was conducted under permits issues by the Washington Department of Ecology (Ecology) and the Franklin County Health and Planning Departments. The landfill was operated by John Dietrich, doing business as Pasco Garbage Service from 1958 to 1971, in conformance with accepted practices as an open burning facility. With the exception of yard waste (vegetation) and brush burning which was halted in mid-1992, all burning was halted in 1971 and the site was converted into a sanitary landfill.

In the early 1970s, Chemical Processors, Inc., a solvent recycling company, ascertained the need for an industrial waste disposal facility. Chemical Processors, Inc., examined several sites in eastern Washington. Mr. John Dietrich dba Basin Disposal, Inc., and Chemical Processors, Inc., then formed Resource Recovery Corporation (RRC) for the purpose of utilizing the Pasco Landfill site for an industrial waste disposal facility. A plan of operations was developed by RRC and submitted to the Franklin County Health Department and Ecology. Following review of the plan for the industrial disposal facility, Ecology approved the plan of operation and issued Industrial Waste Discharge Permit No. 5301 to RRC. The industrial part of the site was operated from late 1972 through 1974 and accepted primarily bulk sludges and drummed wastes. Industrial wastes were segregated into five zones at the facility designated Zones A, B, C, D, and E. The locations of these zones and other landfill "potential source areas" are shown on Figure 2. These zones are described in more detail in Section 3.6.

In 1973, in response to concerns from the agricultural community and the Franklin County Commissioners, Ecology undertook an independent investigation of the RRC facility (Ecology, 1973). This investigation and other investigations previously completed at the site are listed in Table 2.

Table 2

PREVIOUS SITE INVESTIGATIONS

PASCO LANDFILL
PASCO, WASHINGTON

Investigation	Source	Date	Purpose
Resource Recovery Corporation Industrial Disposal Site Evaluation	Washington Department of Ecology	1973	Evaluate site operations and potential environmental impacts
Evaluation of the Pasco Sanitary Landfill Waste Disposal Practices	JUB Engineers	1981	Evaluate site operations
Ground Water Quality in the Vicinity of the Pasco Landfill	JUB Engineers	1983	Evaluate groundwater quality conditions
Preliminary Site Inspection Report of Resource Recovery Corporation, Pasco, Washington	Ecology and Environment, Inc.	1985	Preliminary Site Inspection (PSI) as required under CERCLA program
Final Report for Resource Recovery Corporation, Pasco, Washington	Ecology and Environment, Inc.	1986	Follow-up to PSI in support of site ranking under the CERCLA hazard ranking program
Field Investigation Report for Pasco Sanitary Landfill/Resource Recovery Corporation, Pasco, Washington	Ecology and Environment, Inc.	1987	Follow-up to PSI in support of site ranking under the CERCLA hazard ranking program
Preliminary Health Assessment for the Pasco Sanitary Landfill, Pasco, Franklin County, Washington	United States Department of Health and Human Services, Agency for Toxic Substances and Disease Registry	1990	Preliminary health assessment as required under CERCLA program

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In 1974, the landfill began accepting septic wastes for open pit evaporation and disposal, a practice which was discontinued in 1989. The industrial part of the facility was closed in early 1975. The closure plan was prepared by Ecology and implemented by RRC. The closure plan included moving some wastes to a polyethylene-lined trench and covering all zones with a composite cap of three feet of soil, 4-mil polyethylene sheeting, and an additional two feet of soil.

Monitoring by Ecology in 1975 after closure of the industrial portion of the facility revealed no air, soil, or groundwater contamination with herbicides 2,4-D or 2,4,5-T. Subsequently, in 1979, Ecology relieved RRC of the obligation to perform additional soil and air sampling. Ecology later sampled groundwater in the vicinity. No contaminants were found (Nellermoe, 1988).

In 1981, Pasco Sanitary Landfill, Inc., now owned by Larry Dietrich, took over as owner and operator of the facility. Beginning in 1982, groundwater monitoring wells were installed by JUB Engineers under an Order from Ecology. Those wells, in addition to wells installed after 1982 to monitor the landfill, have been sampled regularly in accordance with WAC 173-304 and the landfill permit.

As part of USEPA's nationwide dioxin investigation, the site was investigated in 1984. This site was included because of known pesticide wastes buried there. No dioxin contamination or other organic contaminants were identified in the water at the site at that time. Ecology and Environment, Inc. (E&E) performed another site investigation in 1985. Their report (E&E, 1986) was completed in June of 1986 and identified several volatile organic compounds (VOCs) present in groundwater at three monitoring wells. They concluded that trace amounts of contaminants may have migrated outside of RRC's burial Zones A, C, D, and E. No evidence of contaminant migration from Zone B was found. The report states: "Groundwater contamination by organics occurred only beneath or adjacent to the former municipal disposal and burn area...".

On June 1988, the USEPA published amendments to the National Priorities List (NPL) that included the Pasco Landfill as a proposed Superfund site. The site was formally included on the NPL list in February 1990.

3 PRELIMINARY CONCEPTUAL SITE MODEL

The Preliminary Conceptual Site Model summarizes the current understanding of the site and addresses sources of contamination, potential exposure routes, and potential human and ecological receptors. Preliminary identification of pertinent laws and regulations and remedial action objectives is also included in this section. This section was based, in part, on the previous investigations listed in Table 2 of Section 2. These investigations were not completed under current MTCA protocol, and therefore may not be entirely acceptable for use in this Phase I RI. Also, all data and information in these investigation reports have not been independently verified and may not be fully accurate.

3.1 Population and Environmental Concerns at Risk

Population data and information on current and future land use trends were gathered to gain an understanding of the general population profile and sensitive subpopulations in the area. Ecological information was obtained from several state agencies for use in assessing the existence of sensitive flora and fauna in the site vicinity.

3.1.1 Population Profile and Land Use

Population concerns were evaluated based on information from the Tri-City Industrial Development and Economic Council (TRIDEC), the Pasco Community Development Department, and the Franklin County Planning Department. The distribution of sensitive subpopulations; anticipated development of the area; and recreation, residential, or tribal use of the area were examined within a one-mile and four-mile radius of the site.

Figure 3 shows the one-mile and four-mile radii around the site. The property surrounding the landfill is zoned C-3 (general business, commercial) and unincorporated county agricultural. Within a one-mile radius of the site, two areas are not zoned general business or agricultural. One of these is property within the Pasco city limits zoned RMH-2 (residential, mobile home). This area is located directly west of the central portion of the site. It was designated RMH-2 in 1960, but has always been agricultural. The future plan for this property is to convert its zoning designation to C-3 (City of Pasco Community Development Department, November 1992). The second is the Tomlinson Dairy property, located to the southeast of the site. This property is zoned RMH-1 (residential, mobile home) to accommodate four mobile homes occupied by Tomlinson Dairy employees (City of Pasco Community Development Department, November 1992).

At most, approximately 40 people work within the one-mile radius. This consists mostly of agricultural workers and the landfill operators. No schools, retirement homes, or recreation areas are located within the one-mile radius.

The four-mile radius encompasses Pasco city limits. Within the four-mile radius, heavy commercial, light industrial, residential-suburban,and agricultural zoning is found. Roughly 21,000 people reside within this radius according to the 1990 U.S. Census. All but approximately 120 of these people live within the west, southwest, and southern directions of the landfill. The remaining people live in the sparsely-populated north, northeast, and eastern directions of the landfill. As of April 1992, 189 seniors were identified living in convalescent homes within the part of the four-mile radius located inside the Pasco City limits. Within the entire four-mile radius, no known tribal claims exist.

Several parks, including Hood Park on the Snake River, a golf course, a yacht marina, and Sacajawea Park are within the four-mile radius, as are most Pasco schools, a hospital, a retirement complex, and dairy and agricultural facilities. Recreational fishing and water sports are enjoyed by the general public within the four-mile radius. A seasonal recreational vehicle park with 30 available spaces, is located at the intersection of Highway 395 and Highway 12, southwest of the landfill. Its occupancy is negligible except during the summer months. Most heavy commercial and light industrial zoning is within the Pasco city limits. A truck stop is

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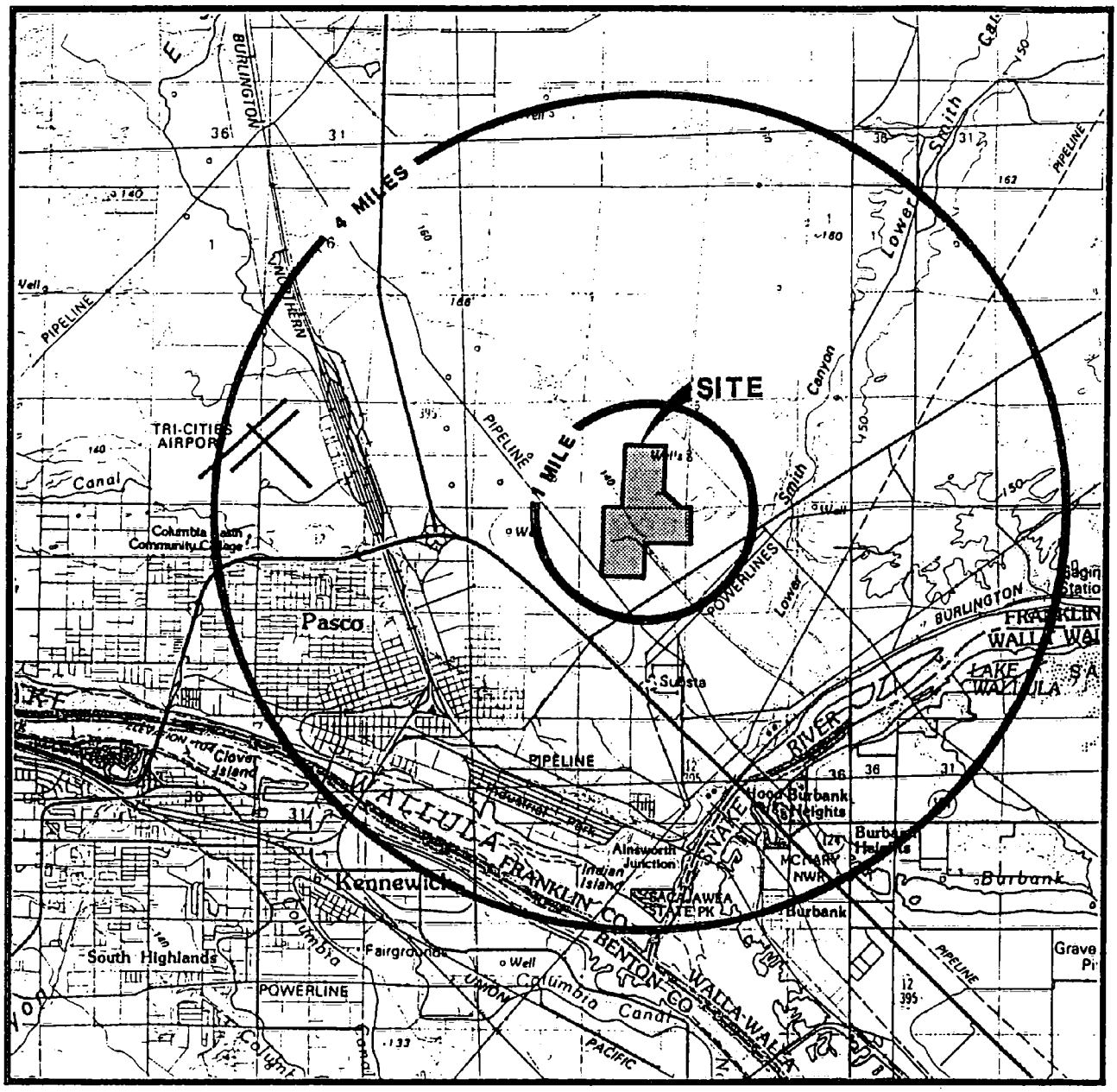

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Modified from U.S. Geological Survey, Richland and Walla Walla, Washington, 30 X 60 minute quadrangle photorevised 1978 and 1980.

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SITE VICINITY MAP

PASO LANDFILL
PASCO, WASHINGTON
624419

FIGURE 3

located approximately two miles north of the site in an area zoned light industrial. Outside Pasco, the county is zoned mostly agricultural. No city water or sewer for residential use is provided outside the city limits.

The northeast portion of the City of Pasco has had plans for expansion since 1986. Other than a mobile home park located north of Lewis Street and south of Highway 12, there is no current residential demand in this area of the city. A planned expansion loop of the city water supply will connect Commercial Avenue with Lewis Avenue. This city annex, located approximately 1.5 miles southwest of the site, is triangular in shape and is bordered by Lewis Street on the south, Highway U.S. 12 to the east/northeast, and Cedar Avenue on the west. At present, the annex is zoned for the following uses:

- general business;
- transitional residential;
- light industrial; and
- retail business.

The City of Pasco is in the process of revising its comprehensive plan and expects a July 1993 availability date. Continued commercial and conventional residential use is planned for this annex. However, currently, a trend towards increased commercial use without an accompanying increase in residential use has been observed (City of Pasco Community Development Department, November 1992).

Further plans for the area encompassing a four-mile radius include a possible agricultural waste processing facility in the Hillsboro area, northwest of the landfill. An urban growth initiative goes into effect in 1992 and most likely will restrict use of the land north and east of the landfill other than its current agricultural and light industrial use. A significant portion of this land is owned by the Washington State Department of Natural Resources (WDNR).

West and southwest of the landfill will likely continue with heavy commercial and industrial use including an expanding truck farm. Directly south of the landfill will likely continue with its present and slowly expanding light industry and agricultural facilities.

3.1.2 Threatened and Endangered Species

The presence of threatened or endangered species within a one-mile radius of the Pasco Landfill was evaluated. To assess the potential proximity of ecologically sensitive populations, Ecology, the WDNR and the Washington State Department of Wildlife (WDW) were contacted.

Ecology maintains the U.S. Fish and Wildlife Services' National Wetlands Inventory (NWI). The NWI is an inventory system which identifies riparian, wetland, and deep water habitats on mapped reports based upon the Cowardin classification system. Under the Cowardin System (Cowardin et al., 1979), wetlands are classified within a hierarchical organization according to plants, soils, and frequency of flooding. The NWI map was prepared through stereoscopic analysis of high-altitude color infrared aerial photographs and is limited to identifying the general location and extent of wetlands within the specific region.

The NWI map shows a pond located approximately one-quarter mile south by southeast of the Pasco Landfill perimeter. This is a man-made dairy pond. This open-water pond is less than six feet deep at its deepest point, and has a tested salinity of less than five milligrams per liter (mg/L). The immediate perimeter of this pond consist of seasonally-emergent plants and is separated from the landfill by a 20-foot rise in land contour.

The WDNR searched the Natural Heritage database system. The Washington Natural Heritage Program is responsible for maintaining information on the state's endangered, threatened, and sensitive plants, as well as high-quality native plant communities and wetlands. At present, they have no record of rare plants, high-quality native wetlands, or high-quality native plant communities in the vicinity of the Pasco Landfill.

The WDW reviewed their database system for nongame species of concern near the Pasco Landfill. Their database is comprised of "element occurrences." An "element" is a natural feature of particular interest because it is exemplary, unique, or endangered on a statewide or nationwide basis. An "element occurrence" is a reported or confirmed locality of a native vegetation community, or a significant habitat for a plant or animal species of concern.

This review of WDW's database did reveal one animal species on this list, *Athena cunicularia* or Burrowing Owl. This animal is designated as a state candidate species under WDW Policy 4802. As such, the owl is managed by the WDW, as needed, to ensure the long-term survival of its population in Washington. The location of this species is confirmed within a ¼-mile radius of the landfill.

On July 28, 1992, the WDW visited the Pasco Landfill to evaluate wildlife habitat under the Priority Habitat Designation Program. Although they did not observe the actual presence of Burrowing Owls, due most likely to the fact that its yearly nesting season is over, WDW did conclude that the site would continue to provide habitat for wildlife as long as some open space is provided. Furthermore, as the landfill is restored to a permanent cover, the WDW believes that this action would most likely have a beneficial effect upon the owls' population and the wildlife community in general (WDW, 1992).

Pertinent correspondence from state agencies pertaining to threatened and endangered species is provided in Appendix A.

3.2 Chemicals of Potential Concern/Exposure Pathways

This section provides a qualitative evaluation of the potential sources of contamination, pathways of exposure, and receptors. The evaluation in this section is based on currently available information regarding the environmental setting and the nature and extent of contamination. Available reports were reviewed to provide an initial focus on the chemicals and exposure pathways of concern.

From the perspective of the federal Agency for Toxic Substances and Disease Registry (ATSDR), the primary migration and exposure pathways of concern relate to the potential future migration of site-impacted groundwater to private drinking water or irrigation wells. The Health Assessment (HA) prepared by ATSDR (1990) states, "The site may pose a future health concern because of the potential for toxic substances to migrate through the groundwater to wells used as a potable water source."

Unauthorized access to the site is restricted due to fencing and rough terrain. The industrial waste disposal areas at the landfill were covered with three feet of soil, a polyethylene liner, and an additional two feet of soil. Except as noted below, in lieu of an engineering evaluation on the expected long-term integrity of the soil cover, it is assumed for this preliminary evaluation that direct contact with buried industrial wastes by the public will not occur.

As the ATSDR report indicates, the primary migration and exposure pathways of concern relate to impacted groundwater. Consequently, the scope of this section focuses on this medium. Although they cannot be fully discounted at this time, impacts to other media and the associated potential exposures are deemed less likely to be significant. These potential exposure routes may include:

- direct contact with the sludge and municipal landfill areas;
- inhalation of impacted dust from the sludge and septage areas; and
- inhalation of landfill gas.

3.2.1 Chemicals of Potential Concern

For project scoping purposes, a listing of the chemicals of greatest relative potential concern was established. This was accomplished through review of the ATSDR HA and other groundwater quality data. The HA conducted by ATSDR indicated the presence of several

chemicals in on-site monitoring wells that exceeded their respective USEPA maximum contaminant levels (MCLs). Those chemicals cited in the HA include:

- 1,1-dichloroethane (1,1-DCA);
- 1,1-dichloroethylene (1,1-DCE);
- 1,1,1-trichloroethane (1,1,1-TCA);
- trichloroethylene (TCE);
- vinyl chloride; and
- xylenes.

The MCL cited in the HA for xylenes was 440 micrograms per liter (ug/L). In January 1991, the USEPA issued a revised MCL for xylenes of 10,000 ug/L (Federal Register, 1991). Before eliminating xylenes as a primary chemical of potential concern (COPC), historical groundwater monitoring results were reviewed to evaluate if xylenes were ever detected at levels exceeding the USEPA MCL of 10,000 ug/L. The highest concentration of xylenes (2,850 ug/L) was detected on March 1990 in Monitoring Well EE-3. This concentration is approximately one order of magnitude below the current USEPA MCL. All mean concentrations for xylenes were at least two orders of magnitude below the current USEPA MCL. Also, reported xylene levels did not exceed Methods B and C criteria established in MTCA or those found in Washington Administrative Code (WAC) 246-290-310 or WAC 173-200-040. As a result, xylenes were not included as a COPC.

The historical groundwater monitoring results were reviewed and compared to both federal and state groundwater criteria to evaluate if other chemicals should be included as COPCs. Since trans-1,2-dichloroethene (trans-1,2-DCE) was detected in monitoring well EE-3 on December 1987 at 190 ug/L, which exceeds the current USEPA MCL of 100 ug/L, this chemical was added as a COPC. Toluene, tetrachloroethene (PCE), and chloroform were also

added as COPCs because maximum concentrations detected exceeded either federal MCLs or MTCA groundwater cleanup criteria. The nine COPCs that will be the focus of this section are:

- chloroform;
- 1,1-DCA;
- 1,1-DCE;
- trans-1,2-DCE
- 1,1,1-TCA;
- PCE;
- TCE;
- toluene; and
- vinyl chloride.

This list of COPCs should be considered preliminary. In the Preliminary Risk Assessment that will be prepared in conjunction with the Phase I RI report, a revised list will be developed based on the site characterization information compiled through the Phase I RI. The revised list will be carried forward to any additional remedial investigations and the Feasibility Study.

3.2.2 Exposure Pathways

Three basic components are necessary before an exposure pathway is considered complete: a source of a hazardous substance, a mechanism for its release and transport in the environment, and either a human or environmental receptor. As previously discussed, the primary contaminant migration pathway identified relates to the migration of site-impacted

groundwater. A review of available project reports was used to provide a preliminary identification of the potential receptor points for the groundwater pathway in context with the local hydrogeological setting (see Section 3.4.1).

For the purposes of this report, groundwater associated with the Pasco Gravel is identified as the shallow aquifer; groundwater associated with the Ringold Gravels is identified as the intermediate aquifer and groundwater associated with the Ringold Clays or the Columbia River Basalt is identified as the deep aquifer. These geologic units are discussed further in Section 3.4.1. Depths to the shallow aquifer range from about 40 to 75 feet (E&E, 1986). The shallow and intermediate aquifers extend to a depth of approximately 140 feet. Groundwater flow is to the southwest with a hydraulic gradient of about 0.004 to 0.005. The site is approximately three miles northeast of the Columbia River at Lake Wallula, which lies directly downgradient. The site is also approximately three miles northwest of the Snake River. The channel of the Snake River is oriented approximately parallel to the hydraulic gradient.

The nearest downgradient off-site user of groundwater was identified as the Tippett Well, which is approximately 1,600 feet downgradient of monitoring well EE-3 (Sweet-Edwards/EMCON, 1988). There is one on-site potable groundwater well, as well as 12 domestic and commercial wells, and 18 irrigation wells within one mile of the site (ATSDR, 1990). As discussed in Section 3.4.2, these ATDSR data differ from the other groundwater usage information gathered for this PCSM. Well records from the U.S. Geological Survey show that most local wells obtain groundwater from the shallow and intermediate aquifers (E&E, 1986). A man-made dairy pond is located approximately 1,500 feet south-southeast of the site; however, groundwater level information from 1985 (E&E, 1986) suggests that the water table is approximately 40 to 70 feet below ground surface in this area. Since this pond is less than six feet deep at its deepest point (Ecology, 1992), it cannot be considered as a potential discharge point for the shallow aquifer.

The preceding information suggests that the most plausible potential human receptors include the local residents downgradient of the site who may use the shallow aquifer for domestic purposes. It should be emphasized that there is no evidence that the residential

groundwater wells have been adversely impacted by site-related contamination. The HA conducted by ATSDR (1990) states, "Currently, no off-site wells show evidence of contamination attributable to the site."

A secondary potential exposure route is associated with users of the intermediate or deep aquifers. At this point, there is no evidence suggesting 1) that intermediate or deep aquifers have been impacted or 2) as stated above, that off-site domestic wells have been impacted by the Pasco Landfill. However, the intermediate and deep aquifers will be addressed through the Phase I RI.

Based on the findings of risk assessments performed at other sites that involved a quantitative evaluation of similar exposure pathways and a recognition of the nature of the chemicals detected, the most critical potential exposure pathways regarding domestic groundwater use appear to be direct ingestion, absorption, and inhalation of VOCs during bathing or showering. In addition, the use of potentially impacted groundwater for crop irrigation must also be considered a potential route of human exposure at this time. However, the degree of volatilization from the irrigation process will likely cause significant reduction in VOC levels prior to plant uptake. Inhalation exposures of field workers may also occur, although potential exposures would be a function of crops grown. The actual ambient air levels of VOCs during irrigation will primarily depend on the levels in the groundwater and the atmospheric conditions.

The results of the upcoming Phase I RI will permit an estimation of the potential current and future exposure point concentrations. These concentrations can then be used to complete a qualitative evaluation of the potential human risks associated with the groundwater pathway.

With respect to possible ecological exposures for the groundwater pathway, two potential exposure points identified for ecological receptors are the Columbia and Snake Rivers. Aquatic plants and animals have the potential to be adversely impacted if site-related chemicals are released in the rivers at concentrations of concern. As previously stated, these rivers are approximately three miles downgradient of the site. The degree of biodegradation, attenuation,

and dilution of the chemicals in groundwater as they migrate toward the river has not yet been evaluated. Therefore, the current information supports the consideration of this ecological exposure pathway.

Potential exposure to groundwater via irrigation or withdrawal will also be evaluated. Other potential ecological pathways include contact, ingestion, and ingestion of biota by predators on the landfill. The plausibility of these pathways will be qualitatively evaluated after all Phase I Remedial Investigation data are compiled and reviewed.

3.3 Hazardous Properties, Environmental Fate, and Form of Potential Contaminants of Concern

A Preliminary Risk Assessment (PRA) will be prepared following USEPA guidance documents and included in the Phase I RI report (see Section 5.7). In addition, in compliance with MTCA, preliminary cleanup levels will be calculated following the procedures identified in WAC 173-340-708(1). During these efforts, the USEPA's Integrated Risk Information System (IRIS) will be the primary source consulted for human health toxicity information (reference doses for non-cancer health effects and cancer slope factors for carcinogenic effects).

Selected toxicity and chemical/physical properties of the COPCs affecting environmental fate and transport were obtained from Chemical, Physical, and Biological Properties of Compounds Present at Hazardous Waste Sites (USEPA, 1985) and Water-Related Environmental Fate of 129 Priority Pollutants (USEPA, 1979). Table 3 provides a summary of toxicity and fate/transport information. A more detailed description of this information is provided below.

The physical properties provided in Table 3 include solubility, vapor pressure, and octanol/water partition coefficient (K_{ow}). These physical properties were selected to illustrate the fate and transport attributes of the COPCs. The K_{ow}, expressed in log 10 values, is an indicator of a chemical's tendency to partition between an organic phase (e.g., soil) and an aqueous phase. In general, low log K_{ow} values are characteristic of more mobile constituents and high log K_{ow} values are characteristic of immobile constituents. Chemicals with log K_{ow}

Table 3

TOXICITY AND FATE/TRANSPORT INFORMATION
OF THE PRELIMINARY CHEMICALS OF POTENTIAL CONCERN

PASCO LANDFILL
PASCO, WASHINGTON

	NONCARCINOGENIC EFFECTS	CARCINOGENIC EFFECTS		Solubility in Water	Vapor Pressure
	Chronic RfD (mg/kg-day)	Oral Slope Factor $(mg/kg\text{-}day)^{-1}$	USEPA Group	at 20°C (mg/L)	at 20°C (mm Hg)
Chloroform	0.01[1]	0.0061	B2	8,200	150.5
1,1-DCA	0.1	---	C	5,000	180
1,1-DCE	0.009[1]	0.6	C	400	591
Trans-1,2-DCE	0.009[2]	---	---	600	200
PCE	0.01	---	B2	150-200	14
1,1,1-TCA	0.09[1]	---	D	480-4,400	123
TCE	---	---	B2	1,100	57.9
Toluene	0.2	---	D	535	28.7
Vinyl chloride	---	1.9[1]	A	1,100	2,660 at 25°C

Primary Source for Toxicity Data: USEPA Integrated Risk Information System Database.

Sources: USEPA, 1979; USEPA, 1985; USEPA, 1992a; and USEPA 1992b.

(1) Health Effects Assessment Summary Tables, FY-1992, March 1992.

(2) Health Effects Assessment Summary Tables, Supplement A, July 1992.

--- Signifies no information available.

11/92/391D90(624419)

values less than 10 are expected to be relatively hydrophilic, highly soluble in water, and have small soil/sediment adsorption coefficients (Lyman, 1982). The low K_{ow} values, in combination with generally high vapor pressures and solubilities, suggest that the COPCs will not be persistent in the soil, but rather will tend to either volatilize under dry conditions or dissolve under saturated conditions.

USEPA's Hazardous Substance Data Bank was used in the evaluation of potential intermediate and final degradation products from soil-groundwater systems for each Chemical of Potential Concern (COPC). Since each biodegradation and abiotic degradation mechanism has process-specific requirements, it is difficult to predict the primary degradation products for each contaminant. Typical process-specific requirements for degradation mechanisms include the presence of oxygen, microorganisms, or various ubiquitous or anthropogenic chemical reagents.

3.3.1 Chloroform

The oral Lowest-Observed-Adverse-Effect-Level (LOAEL) for chloroform is 12.9 milligrams per kilogram per day (mg/kg-day). The critical effect reported is liver lesions. Chloroform is classified by the USEPA as a B2 carcinogen, which indicates that there is sufficient evidence of carcinogenicity in animals and inadequate or no evidence in humans. Chronic administration of chloroform by force-feeding is reported to produce dose-related increases in the incidence of kidney epithelial tumors in rats and hepatocellular carcinomas in mice. Oral doses of chloroform that cause maternal toxicity produce relatively mild fetal toxicity in the form of reduced birth weights. There are limited data suggesting that chloroform has mutagenic activity in some test systems. However, negative results have been reported for bacterial mutagenesis assays.

Volatilization is the major transport process for removal of chloroform from aquatic systems. Once in the troposphere, chloroform is attacked by hydroxyl radicals with the

subsequent formation of phosgene. The portion unreacted in the troposphere may be returned to the earth in precipitation or on particulates, and a small amount may diffuse upward to the stratosphere where it photodissociates via interaction with high-energy ultraviolet light. It appears that neither oxidation nor hydrolysis is an important fate process in the aquatic environment. No information was found to indicate that either bioaccumulation or sorption is an important process for chloroform in the aquatic environment.

There are conflicting data on the biodegradation of chloroform. Slow but substantial biodegradation apparently can occur when the proper microbial population exists that is acclimated to the chemical. Potential degradation products of chloroform in soil-groundwater systems include methylene chloride and methyl chloride.

3.3.2 1,1-DCA

The oral No-Observed-Effect-Level (NOEL) for 1,1-DCA is 115 mg/kg-day. In animals, high doses cause liver and kidney damage and retard fetal development. Limited toxicological testing of 1,1-DCA has been conducted, although the literature indicates that it is one of the least toxic of the chlorinated ethanes. 1,1-DCA is considered a possible human carcinogen by the USEPA. Inhalation exposure to high doses causes central nervous system depression in humans and may cause hepatotoxicity.

Volatilization appears to be the major transport process for removal from aquatic systems. Once in the troposphere, it is attacked by hydroxyl radicals at a relatively rapid rate, so that the tropospheric lifetime is on the order of a month. Little information was found concerning other aquatic fate processes for this compound, but information on analogous compounds suggests that oxidation, hydrolysis, and biodegradation are probably not important for 1,1-DCA. However, since 1,1-DCA is quite volatile, it is probably not very persistent in aquatic environments. Because of its water solubility and relatively low log octanol/water partition coefficient, 1,1-DCA potentially could move through soil and enter the groundwater.

Halogenated aliphatic hydrocarbons are generally considered to be resistant to biodegradation. Potential abiotic degradation products of 1,1-DCA in soil-groundwater systems include chlorethane and vinyl chloride.

3.3.3 1,1-DCE

The oral No-Observed-Adverse-Effect-Level (NOAEL) for 1,1-DCE is 9 mg/kg-day. The critical effect reported is lesions on the liver. 1,1-DCE is considered a possible human carcinogen by the USEPA.

Volatilization appears to be the major transport process for removal from aquatic systems. As with 1,1-DCA, once in the troposphere, 1,1-DCE is attacked by hydroxyl radicals. Neither hydrolysis nor oxidation in the aquatic environment appears to be a significant fate process. No information was found indicating that microorganisms exist that can readily biodegrade 1,1-DCE. In addition, no evidence of bioaccumulation in aquatic organisms or selective adsorption of this compound onto suspended sediments was found.

Under anaerobic conditions in groundwater and landfills, 1,1-DEC undergoes reductive dechlorination to vinyl chloride. 1,1-DCA is another potential degradation product of 1,1-DCE in soil-groundwater systems.

3.3.4 trans-1,2-DCE

The oral NOAEL for trans-1,2-DCE is 17 mg/kg-day. The critical noncarcinogenic effect noted is increased alkaline phosphatase in the blood. trans-1,2-DCE is not classified as a carcinogen. Chronic inhalation exposure causes liver degeneration, and acute exposure to high levels has adverse effects on the central nervous system.

Due to the relatively high vapor pressure of trans-1,2-DCE, volatilization from aquatic systems to the atmosphere is rapid and appears to be the primary transport process. Photo-oxidation in the troposphere appears to be its dominant environmental fate. Once in the troposphere, the compound is attacked at the double bond by hydroxyl radicals, resulting in the formation of formic acid and other compounds. Although little applicable information is available, adsorption is probably an insignificant environmental fate process. The relatively low log octanol/water partition coefficient suggests that bioaccumulation also is a relatively insignificant process.

There are conflicting data on the biodegradation of trans-1,2-DCE. However, there is evidence from various studies that indicates that trans-1,2-DCE can undergo biotransformation under methanogenic conditions to form vinyl chloride.

3.3.5 1,1,1-TCA

The oral NOAEL for 1,1,1-TCA is 500 mg/kg-day. The critical effect noted is hepatotoxicity. 1,1,1-TCA is not classified by the USEPA as a carcinogen. Inhalation exposure to high concentrations depresses the central nervous system, affects cardiovascular function, and damages the lungs, liver, and kidneys in animals and humans. Irritation of the skin and mucous membranes has also been associated with human exposure.

Volatilization is the major transport process for removal from aquatic systems. Once in the troposphere, it is attacked by hydroxyl radicals. Several studies have indicated it may be adsorbed onto organic materials in the sediment. However, the conclusion in USEPA literature indicates that this is probably not an important route of elimination from surface water. 1,1,1-TCA can be transported in the groundwater, but the speed of transport depends on the composition of the soil.

Degradation of 1,1,1-TCA can occur in groundwater under anaerobic conditions to generate 1,1-DCE. 1,1,1-TCA can undergo biotransformation under methanogenic conditions

to form 1,1-DCA and chloroethane. Potential abiotic degradation products of 1,1,1-TCA include phosgene and hydrochloric acid.

3.3.6 PCE

The oral NOAEL for PCE is 14 mg/kg-day. The critical effect noted is hepatotoxicity. PCE is classified as a B2 carcinogen, which indicates that there is sufficient evidence of carcinogenicity in animals and inadequate or no evidence in humans. PCE induces liver tumors when administered orally to mice and is found to be mutagenic using a microbial assay system. Reproduction toxicity is observed in pregnant rats and mice exposed to high concentrations. Animals exposed by inhalation to PCE exhibit liver, kidney, and central nervous system damage.

PCE rapidly volatilizes into the atmosphere where it reacts with hydroxyl radicals to produce hydrochloric acid, carbon monoxide, carbon dioxide, and carboxylic acid. This is probably the most important transport and fate process in surface water and in the environment. PCE will leach into the groundwater, especially in soils of low organic content. In soils with high levels of organics, PCE adsorbs to these materials and can be bioaccumulated to some degree. However, it is unclear if PCE bound to organic material can be degraded by microorganisms or must be desorbed to be destroyed. There is some evidence that higher organisms can metabolize PCE. PCE can be transformed by reductive dehalogenation to TCE, cis- and trans-1,2-DCE and vinyl chloride under anaerobic conditions in soil-groundwater systems. PCE can also be mineralized to carbon dioxide. Additional abiotic degradation products include phosgene and carbon tetrachloride. Other potential biodegradation products include TCE, dichloromethane, and chloroethene.

3.3.7 TCE

TCE is classified as a B2 carcinogen, which indicates that there is sufficient evidence of carcinogenicity in animals and inadequate or no evidence in humans. It is noted that the tumor site for oral exposure is the liver. TCE does not appear to cause reproductive toxicity or teratogenicity.

TCE rapidly volatilizes into the atmosphere where it reacts with hydroxyl radicals to produce hydrochloric acid, carbon monoxide, carbon dioxide, and carboxylic acid. This is probably the most important transport and fate process in surface water and in the upper layer of soil. TCE adsorbs to organic materials and can be bioaccumulated to some degree. However, it is unclear whether TCE bound to organic material can be degraded by microorganisms or must be desorbed to be destroyed. TCE leaches into the groundwater fairly readily.

Microbial degradation by sequential dehalogenation may produce cis-and trans-1,2-DCE and vinyl chloride. In a methanogenic aquifer, biodegradation has also produced 1,2-dichlorethylene and vinyl chloride.

3.3.8 Toluene

The oral NOAEL for toluene is 233 mg/kg-day. The critical effect noted is altered weight in both the liver and kidney. There is no conclusive evidence that toluene is carcinogenic or mutagenic in animals or humans. There is conflicting evidence regarding the teratogenicity of toluene; however, there are no accounts of a teratogenic effect in humans after exposure. Acute exposure to toluene at high concentrations produces central nervous system depression and narcosis in humans. However, even exposure to quantities sufficient to produce unconsciousness fail to produce residual organ damage.

Volatilization appears to be the major route of removal of toluene from aquatic environments, and atmospheric reaction of toluene probably subordinates all other fate processes. Photo-oxidation is the primary atmospheric fate process. The log octanol/water partition coefficient of toluene indicates that sorption processes may be significant. However, no specific environmental sorption studies are available, and the extent to which adsorption by sedimentary and suspended organic material may interfere with volatilization is unknown. Bioaccumulation is probably not an important environmental fate process. Toluene is readily degradable in a variety of standard biodegradability tests. Potential degradation products include benzaldehyde, benzyl alcohol, and cresols.

3.3.9 Vinyl Chloride

Vinyl chloride is classified as a human carcinogen. The tumor sites noted include both the lung and liver. There is suggestive evidence that it has teratogenic and reproductive effects in both humans and animals. Chronic human exposure to vinyl chloride is associated with multiple systemic disorders, including a sclerotic syndrome, acro-osteolysis, and liver damage. Acute human exposure to high concentrations can cause narcosis, respiratory tract irritation, bronchitis, and memory disturbances. Chronic exposure by animals can result in lesions of the liver, kidneys, spleen, and lungs.

Volatilization from aquatic and terrestrial systems is the most important transport process for distribution of vinyl chloride throughout the environment. Photo-oxidation in the troposphere is the dominant environmental fate of vinyl chloride. Photolysis does not appear to be an important fate process in aquatic systems. Furthermore, photo-oxidation destroys vinyl chloride before it can reach the stratosphere, where direct photolysis could occur. Based on available information, hydrolysis, sorption, and bioaccumulation do not appear to be important environmental fate processes. Limited existing data indicate that vinyl chloride is resistant to

biodegradation in aerobic systems. In the presence of hydroxyl radicals, possible degradation products include hydrogen chloride and formyl chloride.

3.4 Geologic and Hydrogeologic Setting and Groundwater Use

3.4.1 Geologic and Hydrogeologic Setting

The Pasco Sanitary Landfill is located at the southern edge of the Pasco Basin geologic province on the Columbia River Plateau. The facility is underlain by a thick sequence of basalts (Columbia River Basalt Group) that are covered by a relatively thin sequence of semi-consolidated and unconsolidated sediments. The sediments that overlie the basalts in this part of the Pasco Basin consist of three units: the Touchet beds at the surface, the Pasco Gravels, and the Ringold Formation. Basalt flows from the Saddle Mountain Basalts form the upper surface of the basalts in this area. The Saddle Mountain Basalts belong to the Yakima River Basalt Subgroup of the Columbia River Basalt Group. A typical local geologic cross section through the landfill property is provided in Figures 4 and 5.

In addition to the three units discussed above, at some locations in the vicinity of the Tri-Cities area of the Pasco Basin, a thin layer of eolian sediment (loess) is reported to be present at or near the surface. The loess is typically described as light brown, very fine sands and silts (E&E, 1986).

The Touchet beds are a series of interbedded basaltic sands and silts that range in thickness from approximately 20 to 60 feet in this part of the Pasco Basin. These sediments were formed by the repeated flooding of the plateau by water from glacial Lake Missoula, which occurred approximately 13,000 years before present. The rhythmic bedding of the Touchet beds

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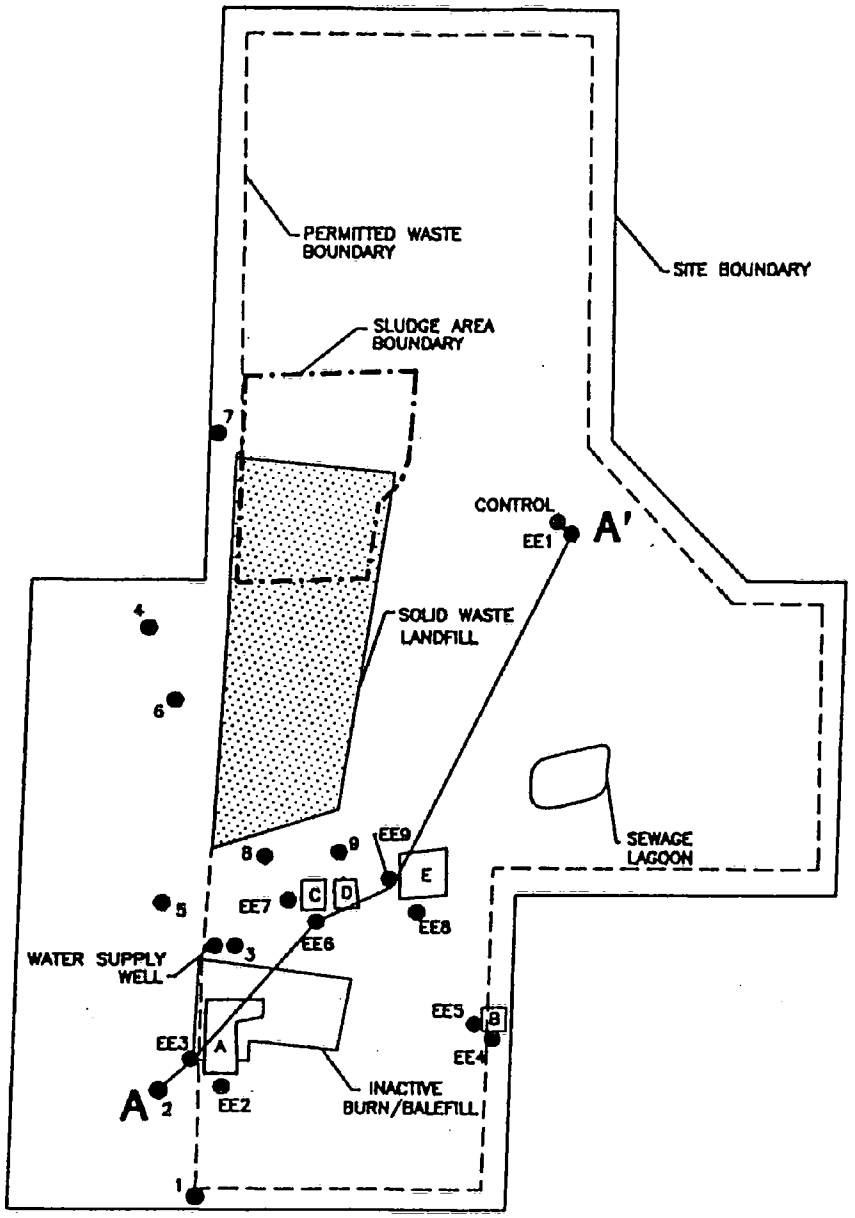

EXPLANATION

● EE2 WELL NUMBER AND APPROXIMATE LOCATION

0 800 1,600
SCALE IN FEET

N

Burlington Environmental Inc.

SECTION A – A'
LOCATION MAP

PASCO LANDFILL
PASCO, WASHINGTON
624419

FIGURE 4

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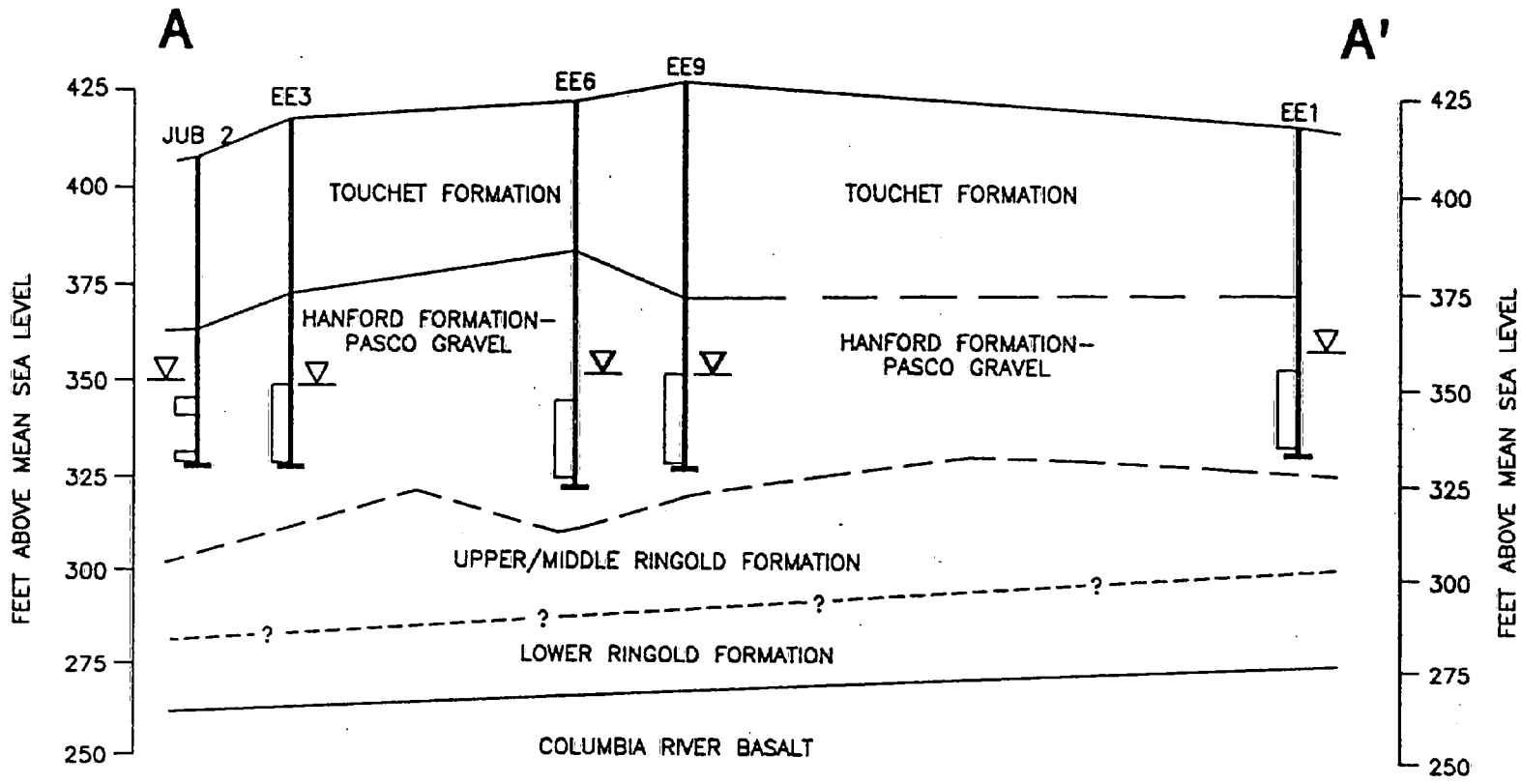

EXPLANATION

EE3 — MONITORING WELL NUMBER AND APPROXIMATE LENGTH OF MONITORING WELL

SCREENED ZONE

GROUNDWATER SURFACE (MEASURED NOVEMBER 1990)

HORIZONTAL SCALE IN FEET

0 500 1000

0 50 100

VERTICAL SCALE IN FEET

General Note:

This profile was developed by interpolation between widely spaced monitoring wells. Only at the monitoring well locations should it be considered as an approximately accurate representation and then only to the degree implied by the notes on the monitoring well logs.

PASCO LANDFILL
PASCO, WASHINGTON
624419

PASCO LANDFILL
GEOLOGIC CROSS SECTION A–A'

FIGURE 5

Burlington Environmental Inc.

resulted from the cyclic nature of the Missoula flooding. The coarser basaltic sand layers resulted from the flood surges and the fine silt layers resulted from the ponding of the flood waters as they passed into the Columbia River Gorge at Wallula Gap. This was repeated numerous times to form the distinctive layering of the Touchet Beds. The hydraulic conductivity of the Touchet beds is reported to range from 0.03 to 3 feet per day (U.S. Department of Energy, 1979). Clastic dikes are present in this layered sequence and are composed of material identical to the Touchet beds. Dikes of up to approximately two feet in width have been observed at the site. Some dikes cut across the entire Touchet sequence at the landfill site.

Underlying the Touchet beds at the landfill site are the Pasco Gravels of the Hanford Formation. These are Missoula Flood Gravels, and range in thickness from 30 to 100 feet. These sediments consist of uncemented silts, sands, and gravels, whose color varies from gray to dark gray. The shallowest occurrence of groundwater at the landfill site is in the Pasco Gravels. The hydraulic conductivity of this sequence normally ranges from 500 to 10,000 feet per day (U.S. Department of Energy, 1979). Data from pumping tests of irrigation wells in the area suggest that the range of hydraulic conductivity is 500 to 700 feet per day.

Underlying the Pasco Gravels, and separated from them by an unconformity, are sediments of the Ringold Formation. The age of the Ringold has been estimated as 4.5 million years (U.S. Department of Energy, 1979). This formation is subdivided into Upper, Middle, and Lower units. The Upper Ringold is composed of cemented lacustrine fine sands and clays. In some areas, the Upper Ringold has been incised by channels from the Lake Missoula flooding. These channels are filled by Pasco Gravels. In the southern portion of the Pasco Basin the Upper Ringold may be absent, resulting in the Pasco Gravels directly overlying the Middle Ringold. Existing site well logs seem to confirm this absence in the Pasco Landfill area.

The Middle Ringold is composed of cemented sands and gravels, gray to tan in color. This gravel can be distinguished from the Pasco Gravel by its greater degree of cementation, the much more weathered appearance of the basalt clasts, the presence of clasts derived from the

Seven Devils Volcaniclastic unit, and a greater incidence of quartzite clasts. Hydraulic conductivity in the Middle Ringold ranges from 10 to 500 feet per day and averages 130 feet per day (U.S. Department of Energy, 1979).

The Lower Ringold consists of a relatively thin layer (20 to 30 feet) of clay overlying the Columbia River Basalts. The hydraulic conductivity of this clay layer is estimated to be at 0.1 to 10 feet per day (U.S. Department of Energy, 1979).

In the period from early 1982 to late 1990, a total of 18 monitoring wells were installed at the Pasco Landfill. These monitoring wells have been periodically monitored and sampled since installation. Based on data from these wells, groundwater beneath the landfill area first occurs in the Pasco Gravels at depths of about 40 to 75 feet. This corresponds to water table elevations ranging from about 360 feet National Geodetic Vertical Datum (NGVD) in the northeast part of the landfill to about 348 feet NGVD in the southwest corner. Based on 1985 groundwater elevation maps presented by E&E (1986), groundwater flows to the southwest under a hydraulic gradient of about 0.004 to 0.005. The groundwater flow rate in the Pasco Gravels at the site is reported to be approximately 1 foot per day (Technico Environmental Services, 1991). Based on the other reported hydraulic conductivity values for the Pasco Gravels of 600 feet per day, flow rates could be as high as 10 feet per day. This rate was calculated using the hydraulic gradients listed above and an estimated effective porosity of 0.25.

The existing monitoring wells are constructed with both single- and double-screen completions. Fourteen of the wells have dedicated Hydrostar or Geoguard sampling systems installed. Table 4 details the elevation of the screen(s) relative to groundwater level, the screen type, and the completion type for each well. Pertinent notes from the boring logs are also provided.

Through the review of the existing monitoring well network and the current analytical groundwater quality database, a preliminary determination of the suitability of the existing groundwater quality information has been made. The data will be considered for qualitative use

Table 4

EXISTING MONITORING WELL NETWORK SUMMARY

PASCO LANDFILL
PASCO, WASHINGTON

Well No.	Elevation - Top of Screen(s) (feet)	Groundwater Elevation (a) (feet)	Screen Type (c)	Elevation Difference - Distance from Top of Screen(s) to Water Table (d) (feet)	Dedicated Sampling System	Selected Boring Log Data
1	342.9/326.9	348.48(b)	D	-5.58/-21.58	None	
2	344.2/328.2	347.19	D	-2.99/-18.99	Hydrostar	
3	349.1/333.1	348.33	D	+.77/-15.23	None	
4	352.75/337.75	351.52	S(c)	+1.23/-13.77	Hydrostar	
5	351.3	347.70	S	+3.6	Hydrostar	
6	353.2	351.31	S	+1.89	Hydrostar	0'-12': loose silty gravel, wood, metal, glass, cinders, concrete, plastic (fill).
7	356.4	354.48	S	+1.92	Hydrostar	
8	352.7	352.52	S	+.18	Hydrostar	
9	353.1	352.89	S	+.21	Hydrostar	
EE-1	352.9	357.92	S	-5.02	Hydrostar	
EE-2	350.8	347.53	S	+3.27	Hydrostar	Garbage hit at two feet.
EE-3	351.1	347.37	S	+3.73	Hydrostar	3'-17': Large amounts of garbage (wood, cans, plastic, etc.)
EE-4	351.6	351.08	S	+.52	None	
EE-5	355.5	351.27	S	+4.23	None	
EE-6	344.9	351.18	S	-6.28	Geoguard	
EE-7	345.8	350.81	S	-5.81	Geoguard	6'-9': Fill material (old car parts, glass, wood, etc.).
EE-8	348.5	351.20	S	-2.70	Geoguard	
Control	360.1/345.1	358.04	D	+2.06/-12.94	Hydrostar	
Water Supply	338.5	NA	S	NA	NA	

(a) 6/25/92 Water levels by Technico Environmental Services

(b) 6/89 Water level by Technico Environmental Services

(c) S = Single screen
D = Double screen

(d) (-) values = Top of screen below water table
(+) values = Top of screen above water table

(e) Lower screen sealed

NA = Not Applicable

bpasco:1313tb4.xls

only at this time. Based on the additional groundwater elevation and quality data to be collected from the existing wells during the Phase I RI, a final determination will be made on the applicability of the data existing for each well (See Section 5.6, Data Evaluation). It is likely that results from the single-screened wells and double-screened wells will not be directly comparable.

3.4.2 Groundwater Use

In an effort to infer general patterns of groundwater use in the vicinity of the landfill, Burlington conducted a limited groundwater use assessment. This assessment involved compiling information on water supply wells and resource protection wells within a circular area centered on the landfill and with radius of approximately 1.5 miles. Two types of information were requested and obtained from Ecology for the assessment: well logs and water rights records. The records request involved Sections 8-11, 14-17, 20-23, and 26-29 in Township 9 North, Range 30 East (Willamette Meridian).

Well logs were received for 32 water supply wells within the 1.5-mile search radius. An additional 7 logs were received for wells that may or may not be within the search area. The location descriptions on these additional logs were not sufficiently clear to identify the locations of the wells. A total of 39 water supply wells potentially lie within the search area. The uses listed on the well logs are summarized in the following table:

domestic:	17
industrial:	3
irrigation:	15
mixed use - domestic and irrigation:	2
mixed use - domestic, industrial, and irrigation:	1
mixed use - domestic and heat exchange:	1

Numerous apparent discrepancies between well location descriptions given in the water rights listings and those given in the well logs were discovered. This precluded the correlation of water rights listings with well logs. Ecology personnel were unable to verify whether any of the locations on the water rights listings had been field checked.

The water rights listing included approximately 15 wells, for which logs were apparently unavailable, potentially within the 1.5-mile search radius. Of these, the locations listed indicated that 10 wells were within the search radius while the remaining 5 may or may not be. The listed uses are summarized in the following table:

domestic:	1
irrigation:	6
mixed use - domestic and irrigation:	4
mixed use - domestic, irrigation, and stock watering:	3
mixed use - industrial and irrigation:	1

For comparison, a letter to USEPA (Technico and Enviro Services Co., 1988) lists 21 drinking water wells and approximately 67 irrigation wells within a 3-mile radius of the Pasco Landfill Site. The ATSDR groundwater well use data discussed in Section 3.2.2 differs from the information summarized above. The differences are due primarily to the dissimilar well use categories employed by ATSDR and the Ecology sources referenced in this section. Also, the study area radii were different.

3.5 Climatic Factors

The National Oceanic and Atmospheric Administration was contacted to obtain climatic information for the Pasco area. A climate data summary document was provided (Monthly

Station Normals of Temperature, Precipitation, and Heating and Cooling Degree Days, 1961-1990, Washington). The closest weather station to the Pasco Landfill is located in Kennewick, Washington, approximately eight miles from the site.

The climate of the Pasco area is arid with mean annual precipitation of 7.49 inches. The hottest months of the year are May through September. The normal (arithmetic mean) high temperature for these months ranges from 75.1 degrees Fahrenheit (°F) to 90.3 °F. The coldest months are November through February. The normal low temperature for these months ranges from 26.1 °F to 34.3 °F.

3.6 Source Identification

The previous investigations listed in Table 2 of Section 2 were not completed under current MTCA protocol and therefore may not be fully acceptable for use in this Phase I RI. Nonetheless, the findings from several of these investigations were used for development of the source identification information provided below. Specifically, the 1986 E&E report was used extensively for development of this section. The waste volumes and waste placement information as well as the remaining text in the 1986 E&E report have not been independently verified.

For the purposes of Phase I RI scoping, the Pasco Landfill has been divided into potential source areas. The division into potential source areas was made on the basis of similar waste materials and similar waste handling or waste disposal methods. The nine potential source areas identified for the Pasco Landfill are burial Zones A, B, C, D, and E; the current municipal solid waste landfill (landfill); the inactive Burn/Balefill area (balefill); the sludge handling area (sludge); and the sewage lagoons (sewage). The depths of all nine areas are reported to be less than 35 feet below grade. Therefore, none of the areas are deep enough to intercept or be in direct contact with the existing water table. The locations of these areas are shown on Figure 2. Descriptions of the waste contents, operational history, and closure methods for these areas

are provided below. An inventory of waste for Zones A through E was completed by a USEPA consultant and is shown in Table 5. The accuracy of this inventory has not been independently confirmed.

3.6.1 Inactive Burn/Balefill

The Pasco Landfill site was originally operated as a municipal waste open burning dump as was accepted practice at that time. The practice of dumping solid waste with periodic burning continued from 1958 until 1971. The garbage disposal operation was then converted to a sanitary landfill, where solid waste was either compacted and covered with soil or compacted into bales, placed on site, and covered with soil. The Burn/Balefill covers an area of about five acres and is estimated to contain more than 50,000 cubic yards of solid waste. Although this waste has not been inventoried, it is expected to be typical of municipal solid waste and may contain small quantities of hazardous materials, such as household hazardous waste.

Use of the Burn/Balefill area for disposal of municipal solid waste ceased prior to 1980. That general area is still used for disposal of large bulk waste such as tree stumps, tires, and concrete. This will cease June 1993 when the current landfill permit expires. The Balefill/Burn area closure consisted of a six- to twelve-inch native soil cover.

3.6.2 Municipal Solid Waste Landfill

Following closure of the burn/balefill area, sanitary waste was disposed in the municipal solid waste landfill. Since 1982, the Pasco Sanitary Landfill has had a conditional use permit from the Franklin County Planning Department to accept municipal wastes. The current landfill

Table 5
WASTE QUANTITIES AND BURIAL LOCATION
PASCO LANDFILL
PASCO, WASHINGTON

Location	Dimensions Lining	Waste Types	Estimated Quantity	Units
Zone A	250' x 150'	Acids	544	drums
		Aromatic Tars	160-248	drums
	bottom unlined	Carcinogenics (unspecified)	9	drums
	top lined	Caustics	8,744	drums
		Cadmium	11	drums
		Metal Finishing	244-304	drums
		Oil Sludge	433	drums
		Paint	10,258-24,200	drums
		Pesticides	425	drums
		Pesticide Containers (empty)	791-863	drums
Zone B	85' x 85'	2,4-D Manufacturing	2,011-5,080	drums
	bottom unlined			
	top lined			
Zone C	110' x 110'	Acids	7,000	drums
		Acid Metal Cleaning	2,301,560	pounds
	bottom unlined	Lime Phenol	684,967	gallons
	top lined	Metal Cleaning	185,162	gallons
		Metal Finishing	17,000-35,724	gallons
			1,460,602-1,949,652	pounds
Zone D	105' x 105'	Aromatic Tar	499,270	pounds
		Cutting Oil	76,350-84,300	gallons
	bottom unlined	Fertilizer Manufacturing	288,288	pounds
	top lined	Oily Sludge	6,000-66,340	gallons
		Paint	72,475-497,418	pounds
		Paint	66,516-95,711	gallons
		Plywood Resin	1,393,380-2,215,440	pounds
		Solvents	12,648	gallons
Zone E	180' x 180'	Chlor-Alkali Sludge	10,500-11,582	tons
	bottom and top lined			
Unknown		Acid Sludges	1,000	gallons
		Acid Wash Solution	312,350	pounds
		Benzoic Acid and Tar	176,000	pounds
		Chemistry Lab Reagents	1	drum
		Chrome Rinse Water	700,901	pounds
		DCP Tar	8,790	gallons
		Etching Solution	1,914	barrels
		Lime Sludge	80-160	drums
		MCPA Bleed	104,318-327,000	gallons
		MCPA Tar	2,965-3,307	drums
			939	drums
			2,813	barrels
			680	pails
		Metal Casing Wastes	3,300-5,760	drums
		Misc. Lab Chemicals	29	small containers
		NH_4+ and NaOH Chemical Solns.	17,238	gallons
		Oily Sludge	116,680	pounds
		Miscellaneous	435	drums
		Pesticide Containers	1,045	each
		Resin Manufacturing	392,553	gallons
		Solid Caustic Soda	44,550	pounds
		Wood Treatment/Preservative Sludges	238	drums
			294,662	gallons

Source: E&E, 1986.
NOTE: The waste inventory in unknown locations may be duplicated in the inventory of Zones A through E. This inventory was prepared by E&E and has not been independently verified.

footprint has been used since 1974 and covers an area of approximately 40 acres in the Southwest Quarter of Section 15 and the Northwest Quarter of Section 22, Township 9 North, Range 30 East. Municipal solid waste is received primarily from Benton, Franklin, and Walla Walla counties. The solid waste is now compacted on site and covered with soil or compacted into bales, placed on site, and covered with soil.

The active landfill contains more than 1,000,000 cubic yards of solid waste. The most recent operations plan indicates that the facility has had the capacity to accept up to 106,000 tons per year of solid waste (Technico Environmental Services, 1991). Currently, less than 50,000 tons per year of solid waste are disposed in the Pasco Landfill. Although this waste has not been inventoried, it is expected to be typical of municipal solid waste and may contain small quantities of hazardous materials, such as household hazardous waste.

3.6.3 Zone A

Within the Burn/Balefill area there is a potential source area designated Zone A. Zone A consists of approximately 0.84 acres. This area was used for the disposal of drummed waste from early 1972 through December of 1974.

Zone A included containerized wastes consisting of paint wastes (sludge, pigments, resins, and colorizers), empty pesticide containers and actual pesticides, wood treatment wastes (such as pentachlorophenol and aromatic tars), metal etching solutions, acids and caustics, and metal casting wastes.

In Zone A, wastes were containerized in drums. The drums were reportedly placed in an unlined trench 250 feet long by 150 feet wide at a depth of less than 30 feet below the current grade (verbal communication, Mr. Larry Dietrich, October 12, 1992). This portion of the landfill facility was closed in 1974. The area closure consisted of three feet of soil under a 4-mil-thick polyethylene-lined top layer. The liner extended to a minimum of 10 feet beyond the

edge of the water runoff trenches. An additional two feet of soil was then placed over the sheeting and smoothed to grade.

3.6.4 Zone B

Zone B is located in Section 22, east of Zone A. Zone B also began accepting drummed waste in 1972. Zone B consists of an area of approximately 0.16 acres constructed by excavating the south side of a small plateau. Zone B was used as a storage area for containerized herbicide wastes consisting primarily of 2,4-D tar, MCPA bleed, and other herbicides associated with the manufacturing of 2,4-D. Due to manufacturing impurities, they may contain tetrachlorodioxin (dioxin) and waste mixtures may contain various phenols and phenoxy acetic acids as sodium salts. Drums were reportedly stacked three tiers high in an unlined trench 85 feet wide by 85 feet long.

Zone B was closed in 1974. Following closure, the barrels were covered with a three-foot soil cap followed by a 4-mil liner and topped off with an additional two feet of soil similar to the closure procedures performed on Zone A.

3.6.5 Zone C

Zone C consists of an unlined pond operated from 1972 until December 1974. The pond covers an area of 0.27 acres. A trench 110 feet wide by 110 feet long was used for evaporation of water from lime sludge and ammonia and ammonia hydroxide solutions. There were also quantities of metal cleaning and metal finishing waste deposited into the Zone C area. Metal finishing wastes generally include etching solutions, metal casting wastes, and chrome plating wastes. These waste products potentially contain a variety of inorganic materials such as chrome salts, aluminum, copper, zinc, iron, titanium, cadmium, and silver.

Closure procedures in Zone C began December 1974. The liquid sludge portions were allowed to dry then a three-foot soil cap was placed over the pit. A 4-mil polyethylene sheet was placed over the initial soil cap and a final two-foot soil cap was placed over the sheeting and brought to grade.

3.6.6 Zone D

Zone D consists of a 0.25-acre area of land. This area was used for the disposal of primarily non-containerized waste from 1972 until closure in 1974. The wastes were sludge materials consisting of aromatic tars, cutting oils, oily sludges, fertilizer manufacturing wastes, paint products, plywood resins and various unknown solvents. The sludge wastes were deposited in an unlined trench approximately 105 feet wide by 105 feet long. At the time of closure the liquid wastes were evaporated to near dry and the sites were covered according to the closure plan specifications. This consisted of a three-foot initial soil cap followed by a 4-mil polyethylene sheet with a two-foot soil cap over the sheet contoured into the natural grade. The wastes were inventoried prior to placement into the trench.

3.6.7 Zone E

Zone E consisted of 0.74-acre area and began accepting waste materials in early 1972. The waste materials were ultimately placed in a polyethylene bottom-lined trench 180 feet wide by 180 feet long. These trenches contain chlor-alkali sludges, mercury contaminated magnesia, and barium sulfate liquors. Chlor-alkali sludge is an insoluble byproduct produced during the manufacturing of chlorine and sodium hydroxide. The sludge potentially contains small quantities of inorganic material such as calcium carbonate, magnesium hydroxide, barium sulfate, and mercury.

Closure procedures began in Zone E in December of 1974. The sludge receptacle area consisted of a bottom-lined trench with moisture sensors placed under the lined area. The sludge wastes were then allowed to dry and a three-foot soil cap was placed over the trench. A 4-mil polyethylene cover was then placed over the initial cap and a two-foot cap was contoured into the surrounding grade over the Zone E trench.

3.6.8 Sewage Lagoon

From 1974 to 1985, the Pasco Sanitary Landfill accepted septic wastes for open pit disposal. These wastes were stored in a sewage lagoon east of the active portion of the landfill. Landspreading was also completed immediately south of the lagoon area. In 1987, the lagoon was closed by allowing the wastes to evaporate dry. Upon evaporation, the wastes were excavated and hauled to the solid waste landfill for use as landfill cover material.

3.6.9 Sludge Handling Area

The sludge handling area has been located directly north of the operational landfill area and has moved north with expansion of the landfill. Most of the sludge handling area is now under the northern end of the current landfill footprint. The most recent sludge handling area was solely in Section 22. The sludge handling area collected sludge primarily from the City of Pasco Waste Water Treatment Plant and other sources from the surrounding area.

Prior to 1988, the landfill accepted approximately 800,000 gallons per year of liquid sludges. These wastes were landspread and allowed to evaporate. Upon evaporation, the wastes were excavated with native sand and used for landfill cover. The landfill footprint then advanced north over the excavated area. Beginning in 1988, the sludge handling area was phased out and has not been in operation since June 1991.

3.7 Preliminary Identification of Applicable or Relevant and Appropriate Requirements

Remedial actions at the Pasco Landfill site must attain the applicable or relevant and appropriate requirements (ARARs) as determined by Ecology under WAC 173-340-710. Remedial actions must also take into account the "to be considered" (TBC) criteria or guidelines if ARARs do not exist or are not sufficiently protective. This identification of preliminary ARARs was based on an evaluation conducted by Burlington, in accordance with USEPA guidance (CERCLA compliance With Other Laws Manual: Interim Final, 1988).

Because this project is being completed under MTCA authority, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) may be an ARAR. The NCP is the blueprint for the Remedial Investigation/Feasibility Study (RI/FS) process, including the means for identifying ARARs. The ARARs identified in the NCP (40 CFR 300.430) will be considered as potential ARARs for cleanup actions at the site.

A requirement may be either "applicable" or "relevant and appropriate" to remedial activities at a site, but not both. Applicable requirements are those clean-up standards, standards of control and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at the site. A remedial action must satisfy all the jurisdictional prerequisites of a requirement for the requirement to be applicable. For example, USEPA specifically states that RCRA minimum technology requirements would be applicable for construction of a new hazardous waste landfill at a CERCLA site.

If a regulation is not "applicable," it may still be "relevant and appropriate." Relevant and appropriate requirements mean those clean-up standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstances at the site, address problems or situations sufficiently similar to those at the particular site. For example, MCLs established

under the Safe Drinking Water Act may not be applicable to a site where groundwater is used as drinking water from a private well since a single residential well may not be considered a public water supply under the Safe Drinking Water Act definition. However, MCLs may be relevant and appropriate to the situation.

Non-promulgated advisories or guidance documents issued by Federal or State governments do not have the status of potential ARARs. However, these advisories and guidance are to be considered when determining protective clean-up levels.

There are three basic types of ARARS: chemical-specific, location- specific, and action-specific. Chemical-specific ARARs regulate the release of materials having certain chemical or physical characteristics, or materials containing specific chemical compounds, to the environment. These requirements generally set health-based or risk-based concentration limits for specific chemicals. A drinking water standard is a type of chemical-specific ARAR.

Location-specific ARARs pertain to the geographical or physical position of the site, rather than to the nature of the contaminants or the proposed site remedial actions. These requirements may impose additional constraints on the remedial action or limit the type of remedial actions that can be implemented. Restrictions on activities in wetlands are a type of location-specific ARAR.

Action-specific ARARs prescribe treatment and disposal procedures for hazardous substances. These ARARs generally set performance, design, or other similar action-specific requirements for activities related to management of hazardous substances or pollutants. As several alternative remedial actions usually are evaluated for a site, different requirements have to be evaluated. The action-specific requirements do not determine the remedial alternative; they indicate how to (or to what level) treatment or cleanup will have to be achieved. Standards for landfill design are a type of action-specific ARAR.

The identification of ARARs is an iterative process. The following sections present potential chemical-specific and location-specific ARARs for the site. At this time, action-specific ARARs are not identified; it is more appropriate to identify action-specific ARARs at

a later time when the Feasibility Study is being prepared and the type of remedial actions being considered are more defined.

3.7.1 Potential Chemical-Specific ARARs and TBCs for Groundwater

Findings from review of potential groundwater ARARs and TBCs are summarized in Table 6 and discussed below.

3.7.1.1 Federal Primary Maximum Contaminant Levels

Maximum Contaminant Levels (MCLs) are federal drinking water standards promulgated under the Safe Drinking Water Act (40 CFR 141). Generally, an MCL for a toxic chemical represents the allowable lifetime exposure to the chemical for a 70-kilogram adult who is assumed to ingest two liters of water per day. In addition to health factors, an MCL is required by law to reflect the technological and economic feasibility of removing the chemical from the water supply. MCLs must be feasible given the best available technology and treatment techniques. Most MCLs are applicable at the tap of a water system, but MCLs are relevant and may be appropriate for groundwater that is a potential source of drinking water. Also, MCLs have been used as a "benchmark" for aquifers unlikely to be used as potable drinking water sources (e.g., shallow aquifers).

3.7.1.2 Federal Non-zero MCL Goals

Maximum Contaminant Level Goals (MCLGs) are promulgated under the Safe Drinking Water Act (40 CFR 141) as health criteria used in setting MCLs and other enforceable drinking

Table 6

POTENTIAL ARARs and TBCs FOR GROUNDWATER

PASCO LANDFILL
PASCO, WASHINGTON

Chemical	Potential ARARs				Criteria TBC
	Federal MCL	Federal MCLG	State MTCA	State MCL	Federal HA
Chloroform	0.10	NA	0.007	0.10	NA
1,1-DCA	NA	NA	NA	NA	NA
1,1-DCE	0.007	0.007	0.00007	0.007	0.007
trans-1,2-DCE	0.1	0.1	0.160	NA	0.1
PCE	0.005	NA	0.080	NA	NA
1,1,1-TCA	0.2	0.2	NA	0.200	0.2
TCE	0.005	NA	NA	0.005	NA
Toluene	1	1	1.6	NA	1
Vinyl chloride	0.002	NA	0.00002	0.002	NA

Notes:
Concentrations are presented in milligrams per liter (mg/L).

MTCA Cleanup Levels were not adjusted downward for multiple exposure pathways or multiple chemicals; cleanup levels were based on Method B calculations.

GW = Groundwater.
HA = Health Advisory (based on a lifetime of exposure).
MCL = Maximum Contaminant Level.
MCLG = Maximum Contaminant Level Goal.
MTCA = Model Toxics Control Act.
NA = Not available.
TBC = To be considered.
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water standards. MCLGs are not enforceable standards. An MCLG is based only on health considerations and represents a level at which no adverse effects occur. Non-zero MCLGs are generally relevant and may be appropriate for groundwater that is a potential source of drinking water. Zero MCLGs are specifically excluded as ARARs in the NCP.

3.7.1.3 Federal Drinking Water Health Advisories

The non-regulatory health advisories from the USEPA Office of Drinking Water are chemical concentrations in drinking water at which adverse effects are not anticipated to occur. A margin of safety is included to protect sensitive members of the population. The health advisory values are developed from data describing non-carcinogenic end-points of toxicity only (i.e., the values do not incorporate potential carcinogenic risk from exposure to the chemical). Although health advisories are not legally enforceable, they are criteria to be considered during the development of cleanup levels.

3.7.1.4 RCRA Groundwater Protection Standards

Concentration limits for specific constituents in groundwater impacted by Resource Conservation and Recovery Act (RCRA) facilities are provided in 40 CFR Part 264.94. For constituents not listed, these regulations set the cleanup standard at background levels. These regulations also provide a mechanism for establishing alternate groundwater cleanup standards. The cleanup standards, known as Alternate Concentration Limits (ACL), are based on the characteristics of the waste, hydrogeologic conditions at the site and numerous other criteria related to the potential impacts of the waste to human health and the environment.

3.7.1.5 Washington State Groundwater Quality Criteria

Washington State has developed groundwater quality criteria that apply to all groundwaters in the state. The criteria are presented in WAC 173-200. Groundwater quality standards are not applicable to cleanup actions approved by the department under Washington State's MTCA. However, the criteria may be relevant and appropriate to aspects of the Phase I RI, including the pump test.

3.7.1.6 Washington State MCLs

Washington State has promulgated MCLs for drinking water. The MCLs are presented in WAC 246-290-310. State MCLs are applicable to cleanup actions at the site.

3.7.1.7 Washington State MTCA

Washington State has developed groundwater cleanup levels under MTCA, preliminary groundwater cleanup levels were evaluated based on Method B. Method B cleanup levels must be at least as stringent as all of the following:

- concentrations established under applicable state and federal laws, including federal MCLs, federal MCLGs (other than those set at zero), federal secondary MCLs, and state MCLs;
- for those chemicals for which sufficiently protective, health-based criteria have not been established under applicable state and federal laws, those concentrations which protect human health, as determined by the equations presented in WAC 173-340-720(3)(a)(ii)(A) and (B); and

- Ecology may establish cleanup levels that are more stringent than those mentioned above, but only if Ecology demonstrates such levels are necessary to protect human health and the environment.

According to WAC 173-340-720(5), cleanup levels for individual chemicals must be adjusted downward to account for exposure to multiple hazardous substances and/or exposure pathways. In making adjustments, the non-cancer hazard index may not exceed one and the total excess cancer risk may not exceed one in 100,000. It should be noted that the concentrations presented in Table 6 have not been adjusted downward.

3.7.2 Potential Chemical-Specific ARARs for Surface Water

Potential surface water ARARs were identified since site groundwater may release to the Columbia or Snake Rivers. It is assumed that the designated beneficial uses of these rivers are drinking water and protection of aquatic life. Table 7 and the text below summarize the findings of the initial surface water ARAR review.

3.7.2.1 Federal Ambient Water Quality Criteria for Humans

The USEPA has promulgated ambient water quality criteria for the protection of human health. These criteria address exposures from water and fish consumption. In 1991, the USEPA proposed revised criteria based on updated toxicity information. The revised values are presented in 40 CFR Part 131.36; Proposed Rules. At this time, the criteria are used as guidelines by states and are not enforceable standards. These water quality criteria may be relevant and appropriate to cleanup actions at the site.

Table 7

POTENTIAL ARARs FOR SURFACE WATER

PASCO LANDFILL
PASCO, WASHINGTON

Chemical	Protection of Human Health				Protection of Aquatic Life
	Federal WQC (Fish/Water)	Federal WQC (Fish)	State WQC	State MTCA	Federal WQC
Chloroform	0.0057	0.470	NA	0.3	1.24
1,1-DCA	NA	NA	NA	NA	NA
1,1-DCE	0.000057	0.0032	NA	0.002	11.6(a)
trans-1,2-DCE	0.7	140	NA	32	11.6(a)
PCE	0.0008	0.00885	NA	0.8	NA
1,1,1-TCA	3.1	170	NA	NA	18(a)
TCE	0.0027	0.081	NA	NA	21.9
Toluene	6.8	200	NA	48	17.5(a)
Vinyl chloride	0.002	0.525	NA	0.003	NA

Notes:

Concentrations are presented in milligrams per liter (mg/L).

Federal Water Quality Criteria for protection of aquatic species based on chronic exposures unless indicated by an (a), designating no chronic value available and the acute concentration is presented.

MTCA Cleanup Levels were not adjusted downward for multiple exposure pathways or multiple chemicals; cleanup levels were based on Method B calculations.

MTCA = Model Toxics Control Act.
NA = not available.
WQC = water quality criteria.

3.7.2.2 Federal Ambient Water Quality Criteria for Aquatic Life

The USEPA also has promulgated ambient water quality criteria for the protection of aquatic life. These criteria are presented in 45 FR 79318. The ambient water quality criteria are also unenforceable guidelines but may be relevant and appropriate to site cleanup actions.

3.7.2.3 Washington State Water Quality Standards

Washington State has promulgated surface water quality standards. These standards are listed in WAC 173-201-047. These standards are applicable to site cleanup actions affecting surface water.

3.7.2.4 Washington State MTCA

Washington State has developed surface water cleanup levels under MTCA. Preliminary surface water cleanup levels were identified based on Method B. Method B cleanup levels must be at least as stringent as all of the following:

- concentrations established under applicable state and federal laws, including state surface water quality standards, and water quality criteria for the protection of aquatic organisms and human health;
- concentrations which are estimated to result in no adverse effects on the protection and propagation of wildlife, fish, and other aquatic life;

- for those chemicals for which sufficiently protective, health-based criteria have not been established under applicable state and federal laws, those concentrations which protect human health as determined by the equations presented in WAC 173-340-730(3)(a)(iii)(A), (B), and (C); and

- Ecology may establish cleanup levels more stringent than those mentioned above, but only if Ecology demonstrates such levels are necessary to protect human health and the environment.

It should be noted that the concentrations presented in Table 7 have not been adjusted downward for multiple chemicals and multiple exposure pathways.

3.7.3 Potential Chemical Specific ARARs for Soil

Findings from the review of potential soil ARARs are summarized in Table 8 and the text below.

3.7.3.1 RCRA Soil Cleanup Standards

Current federal RCRA policy indicates that state agencies shall set threshold levels for contaminants in soils, above which the soils shall be handled as hazardous waste. These threshold levels will be risk-based, and set on a case-by-case basis. The threshold levels may be applicable to cleanup actions at the site.

Table 8
POTENTIAL ARARs FOR SOIL

PASCO LANDFILL
PASCO, WASHINGTON

Chemical	State MTCA
Chloroform	164
1,1-DCA	NA
1,1-DCE	1.67
trans-1,2-DCE	1,600
PCE	800
1,1,1-TCA	NA
TCE	NA
Toluene	16,000
Vinyl chloride	0.53

Notes:

Concentrations are presented in milligrams per kilogram (mg/kg).

MTCA Cleanup Levels were not adjusted downward for multiple exposure pathways or multiple chemicals; cleanup levels do not consider protection of groundwater or air; cleanup levels were based on Method B calculations (WAC 173-340-745).

MTCA = Model Toxics Control Act.
NA = not available.

3.7.3.2 Washington State MTCA

Preliminary soil cleanup levels under MTCA were identified in accordance with residential areas (Method B). Method B cleanup levels must be at least as stringent as all of the following:

- concentrations established under applicable state and federal laws;
- concentrations which will not cause contamination of groundwater at levels which exceed Method B groundwater cleanup levels;
- for chemicals for which health-based criteria have not been established under applicable state and federal laws, those concentrations which protect human health, as determined by the equations presented in WAC 173-340-740(3)(a)(iii)(A) and (B); and
- Ecology may establish cleanup levels that are more stringent than those mentioned above but only if Ecology demonstrates such levels are necessary to protect human health and the environment.

It should be noted that the concentrations presented in Table 8 have not been adjusted downward for multiple chemicals and multiple exposure pathways.

3.7.4 Potential Chemical-Specific and Action-Specific ARARs for Air

Table 9 and the text below summarize the air ARAR review completed for this project.

Table 9
POTENTIAL ARARs FOR AIR

PASCO LANDFILL
PASCO, WASHINGTON

Chemical	State APC	State MTCA
Chloroform	NA	0.0012
1,1-DCA	NA	0.160
1,1-DCE	NA	0.00001
trans-1,2-DCE	NA	NA
PCE	NA	NA
1,1,1-TCA	NA	1.480
TCE	NA	NA
Toluene	NA	0.160
Vinyl chloride	NA	0.000004

Notes:

Concentrations are presented in milligrams per cubic meter (mg/m^3).

MTCA cleanup levels were not adjusted downward for multiple exposure pathways or multiple chemicals; cleanup levels were based on Method B calculations.

APC = air pollution control criteria.
MTCA = Model Toxics Control Act.
NA = not available.

3.7.4.1 Washington State Air Pollution Control Regulations

Washington State has promulgated air pollution control standards. The standards are presented in WAC 173-400 through 173-490. These standards are applicable for cleanup actions at the site and are action-specific if applied to a new source. If applied to a particulate emission from the site, these regulations are chemical-specific.

3.7.4.2 Washington State MTCA

Preliminary air cleanup levels under MTCA were identified in accordance with residential areas (Method B). Method B cleanup levels must be at least as stringent as all of the following:

- concentrations established under applicable state and federal laws;
- for chemicals for which sufficiently protective health-based criteria have not been established under applicable state and federal laws, those concentrations which protect human health, as determined by the equations presented in WAC 173-340-750(3)(ii)(A) and (B); and
- Ecology may establish cleanup levels more stringent than those mentioned above but only if Ecology demonstrates such levels are necessary to protect human health and the environment.

It should be noted that the concentrations presented in Table 9 have not been adjusted downward for multiple chemicals and multiple exposure pathways.

3.8 Preliminary Identification of Remedial Objectives and Alternatives

A preliminary list of remedial action objectives for potentially contaminated media at the Pasco Landfill site has been assembled in Table 10. Formulation of this table follows the guidelines in Section 2 of Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites (USEPA, 1991a). Table 10 also outlines potential remedial technologies, process options. The remedial action objectives and technologies were collected on the basis of review of existing site data and the conceptual site model as outlined in this Work Plan. Various accepted remedial technologies were considered, including those listed in the Superfund Innovative Technology Evaluation (SITE) Program (USEPA/540/5-90/006, 1990).

The technologies outlined in Table 10 will help focus the site investigation activities and will form the basis for the ensuing Feasibility Study (FS). As the Remedial Investigation/Feasibility Study (RI/FS) process progresses, technology alternatives will be refined or eliminated, and if appropriate, new technologies will be considered.

Table 10

PRELIMINARY REMEDIAL ACTION OBJECTIVES

PASCO LANDFILL
PASCO, WASHINGTON

Media	Contaminants/Materials of Concern	Remedial Action Objective	Remedial Technology	Technology Objective	Process Option
Surface Soil/Sediments	- Municipal sewage sludges - Septic wastes (from sludge and sewage areas, used as daily landfill cover	Prevent ingestion, inhalation, dermal absorption and bioconcentration	No Action	-----	-----
			Vegetation Enhancement	Mobility reduction	Vegetation
			Fencing	Limit access to site	Fence
			Deed Restrictions	Limit access to site	Access/development restrictions
			Cap	Isolation	Native soil cover
					Single-barrier cap
					Composite-barrier cap
			Excavation/On-site Consolidation	Isolation - RCRA landfill	Double liner/cap with leachate control
			Excavation/On-Site Consolidation	Isolation - on-site solid waste landfill	MFS requirements
			Excavation/Off-site Consolidation	Isolation - RCRA landfill	Double liner/cap with leachate control
			Treatment (Onsite)	Destruction - on-site RCRA incinerator	Thermal
				Isolation	Solidification/fixation
			Treatment (Offsite)	Destruction - off-site RCRA incinerator	Thermal
				Isolation	Solidification/fixation

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Table 10, continued

PRELIMINARY REMEDIAL ACTION OBJECTIVES

PASCO LANDFILL
PASCO, WASHINGTON

Media	Contaminants/Materials of Concern	Remedial Action Objective	Remedial Technology	Technology Objective	Process Option
Subsurface Soil/ Landfill Contents	Zone A - Drummed paint wastes - Pesticides - Wood treatment wastes - Acids and caustics Zone B - Drummed herbicide manufacturing waste (2,4-D) - Possible dioxins and phenols	Prevent ingestion, inhalation, or dermal absorption	No Action	-----	-----
			Deed Restrictions	Limit access to areas	Access/development restrictions
			Fencing	Limit access to areas	Fence
			Surface Controls	Runoff/infiltration control	Grading
					Vegetation enhancement
			Cap	Isolation	Native soil cover
					Single-barrier cover
					Multiple-barrier cover
			Drum Removal and On-site Consolidation	Isolation - on-site RCRA landfill	Double liner/cap
			Drum Removal and Off-Site Consolidation	Isolation - off-site RCRA landfill	Double liner/cap
			Drum Removal and On-Site Treatment	Destruction - on-site RCRA incinerator	Thermal
			Drum Removal and Off-Site Treatment	Destruction - off-site RCRA incinerator	Thermal
			Vapor Extraction	Recovery and destruction or disposal	Vapor extraction with carbon adsorption or incineration

Table 10, continued

PRELIMINARY REMEDIAL ACTION OBJECTIVES

PASCO LANDFILL
PASCO, WASHINGTON

Media	Contaminants/Materials of Concern	Remedial Action Objective	Remedial Technology	Technology Objective	Process Option
Subsurface Soil/ Landfill Contents	Zone C - non-containerized lime sludge - ammonia hydroxide solutions - metal cleaning and finishing wastes and plating wastes Zone E - non-containerized chlor-alkali sludge - mercury-contaminated magnesia and barium sulfate liquids	Prevent ingestion, inhalation, or dermal absorption	No Action	-----	-----
			Deed Restrictions	Limit access to areas	Access/development restrictions
			Fencing	Limit access to areas	Fence
			Surface Controls	Runoff/infiltration control	Grading
					Vegetation enhancement
			Cap	Isolation	Native soil cover
					Single-barrier cover
					Multiple-barrier cover
			Excavation/On-site Consolidation	Isolation - on-site RCRA landfill	Double liner/cap with leachate control
			Excavation/Off-site Consolidation	Isolation - off-site RCRA landfill	Double liner/cap with leachate control
			Excavation/On-site Treatment	Destruction - on-site RCRA incinerator	Thermal
				Neutralization/detoxification	pH adjustment
					Metals precipitation
					Oxidation
				Isolation	Solidification/stabilization
			Excavation/Off-site Treatment	Destruction - off-site RCRA incinerator	Thermal

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Table 10, Continued

PRELIMINARY REMEDIAL ACTION OBJECTIVES

PASCO LANDFILL
PASCO, WASHINGTON

Media	Contaminants/Materials of Concern	Remedial Action Objective	Remedial Technology	Technology Objective	Process Option
Subsurface Soil/ Landfill Contents	Zone D - non-containerized tars, oils, oily sludges, fertilizer wastes, paints, resins, and solvents	Prevent ingestion, inhalation, or dermal absorption	No Action	-----	-----
			Deed Restrictions	Limit access to area	Access/development restrictions
			Fencing	Limit access to area	Fence
			Surface Controls	Runoff/infiltration control	Grading
					Vegetation enhancement
			Cap	Isolation	Native soil cover
					Single-barrier cover
					Multiple-barrier cover
			Excavation/On-site Consolidation	Isolation - on-site RCRA landfill	Double liner/cap with leachate control
			Excavation/Off-site Consolidation	Isolation - off-site RCRA landfill	Double liner/cap with leachate control
			Excavation/On-site Treatment	Destruction - on-site RCRA incinerator	Thermal
				Destruction - biological degradation	Biological treatment
				Isolation	Solidification/stabilization
			Vapor Extraction	Recovery and destruction or disposal	Vapor extraction with carbon adsorption or incineration
			Excavation/Off-site Treatment	Destruction - off-site RCRA incinerator	Thermal

bpasco:1313.9

Table 10, Continued

PRELIMINARY REMEDIAL ACTION OBJECTIVES

PASCO LANDFILL
PASCO, WASHINGTON

Media	Contaminants/Materials of Concern	Remedial Action Objective	Remedial Technology	Technology Objective	Process Option
Subsurface Soil/ Landfill Contents	Municipal landfill wastes	Prevent leaching of waste, direct human contact with waste, or dispersion by air, and runoff	No Action	-----	-----
			Deed Restrictions	Limit access to area	Access/development restrictions
			Fencing	Limit access to area	Fence
			Surface Controls	Runoff/infiltration controls	Grading
					Vegetation enhancement
			Cap	Isolation	Native soil cover
					Single-barrier cap
					Multiple-barrier cap
Air/Dust	Various potential contaminants associated with present landfill and former sludge and sewage management areas	Prevent ingestion, inhalation, or dermal adsorption	No Action	-----	-----
			Vegetative Enhancement	Containment	Containment
			Cap	Containment	Native soil cover

bpasco:1313.9

Table 10, continued

PRELIMINARY REMEDIAL ACTION OBJECTIVES

PASCO LANDFILL
PASCO, WASHINGTON

Media	Contaminants/Materials of Concern	Remedial Action Objective	Remedial Technology	Technology Objective	Process Option
Groundwater and Leachate	Volatile organic compounds	- prevent ingestion, inhalation or dermal adsorption - prevent migration to surface waters or wells	No Action	-----	-----
			Institutional Controls	Provide alternate water supply	Public water
			Vertical Barrier	Containment	Slurry wall
			Horizontal Barrier	Containment	Bottom sealing
			Extraction	Collection	Extraction wells
					Leachate drains/trenches
			Extraction and Injection	Collection and migration control	Extraction and injection wells
			Physical Treatment	Removal of contaminants from water	Activated-carbon adsorption
					Air stripping
					Steam stripping
					Thin-film evaporation
					Freezing evaporation
			Chemical Treatment	Transformation of contaminants to non-toxic compounds	Wet air oxidation
					Ozone oxidation
					UV/peroxide oxidation
					$KMnO_4$ Oxidation
			Biological Treatment	Transformation of contaminants to non-toxic compounds	Aerobic surface reactor
					Aerobic in situ biotreatment

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Table 10, continued

PRELIMINARY REMEDIAL ACTION OBJECTIVES

PASCO LANDFILL
PASCO, WASHINGTON

Media	Contaminants/Materials of Concern	Remedial Action Objective	Remedial Technology	Technology Objective	Process Option
Treated Groundwater/ Leachate	Possible low levels of volatile organic compounds (below applicable cleanup ARARs)	disposal of treated groundwater/leachate	On-site Discharge	Disposal and gradient control	Aquifer injection wells
				Surface dust control	Surface spreading
			Off-site Discharge	Disposal	Public-owned treatment works
				Disposal and irrigation	Adjacent field irrigation
Landfill Gas	- methane - H_2S - volatile organic compounds - explosion hazard	- prevent infiltration of toxic compounds - control explosion hazard	No Action	-----	-----
			Monitoring Probes	Monitoring	Monitoring probes
			Collect and Flare	Destruction	Pipe vents/flare
					Trench vents/flare
					Extraction wells/flare
			Passive Venting	Dispersion	Pipe vents
					Trench vents
					Extraction wells
			Air Injection	Dilution/migration control	Injection wells
Surface Waters	possible low levels of volatile and semivolatile organic compounds, metals, pesticides, and herbicides	Prevent ingestion or dermal absorption of possible contaminants	No Action	-----	-----
			Monitoring/sampling	Monitoring	Sample and analyze
			Stormwater controls	Infiltration and runoff management	Grading
					Vegetative enhancement
			Surface controls	Collection	Surface diversion system
			Treatment	See groundwater/leachate objectives	See groundwater/leachate process options

bpasco:1313.9

4 WORK PLAN RATIONALE

The Work Plan approach began with existing data evaluation and development of the PCSM. This information was used to establish data needs with respect to waste locations and impacts to surface and subsurface soils and groundwater. General Phase I RI objectives are summarized on Table 11.

The Phase I RI is designed to collect information on the types, levels, and vertical and horizontal distribution of contamination in soils and groundwater. Geophysical and soil-gas programs will be implemented to support this characterization work. Also, an air monitoring program will be completed to provide information for use in the Preliminary Risk Assessment.

The data gathered through the Phase I RI field and analytical work will be handled under strict protocol specified in the Data Management Plan (Volume III) to ensure integrity of the data is maintained. All pertinent information gathered will be used to complete the Preliminary Risk Assessment. The site characterization information and the Preliminary Risk Assessment findings will then be presented in the Phase I RI Report.

The data requirements for both the Phase I RI site characterization and the Preliminary Risk Assessment are summarized in this section. These data requirements were identified through the development of Data Quality Objectives (DQOs). DQOs are qualitative and quantitative statements specified to ensure that the data generated in this Phase I RI are of known and appropriate quality.

4.1 Data Quality Objectives

The CERCLA guidance Data Quality Objectives for Remedial Response Activities, (USEPA/540/G-87/003 and 004) and Ecology guidance Guidelines and Specifications for Preparing Quality Assurance Project Plans, (91-16, 1991), were used in the development of DQOs for this project. Table 12 summarizes the results of the DQO development process.

Table 11

GENERAL PHASE I REMEDIAL INVESTIGATION OBJECTIVES

PASCO LANDFILL
PASCO, WASHINGTON

Objective	RI Activity
- Identify presence or absence of contaminants.	- Establish presence/absence of contaminants at source and in pathways.
- Identify types of contaminants.	- Establish "nature" of contaminants at source and in pathways.
- Identify concentrations of contaminants.	- Establish concentration gradients.
- Identify mechanism of contaminant release to pathways.	- Establish mechanics of source/pathway(s) interface.
- Identify direction of pathway(s) transport.	- Establish pathway(s)/transport route(s). Identify potential receptor(s).
- Identify environmental/public health factors.	- Establish routes of exposure and environmental and public health threat.

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Table 12

DATA QUALITY OBJECTIVES SUMMARY

PASCO LANDFILL
PASCO, WASHINGTON

Activity	SOIL			GROUNDWATER		AIR	
	Background Sample	Surface Sample	Subsurface Sample	Background Sample	Well Sample	Soil-Gas Sample	Landfill Gas Sample
Data Use Priority	- Site character. - Risk assessment	- Site character. - Risk assessment - Evaluation of alternatives - Engineering design of remedial action - Monitoring during implementation of remedial action	- Site character. - Risk assessment - Evaluation of alternatives - Engineering design of remedial action - Monitoring during implementation of remedial action	- Site character. - Risk assessment - Engineering design of remedial action	- Site character. - Risk assessment - Evaluation of alternatives - Engineering design of remedial action - Monitoring during implementation of remedial action	- Site character. - Risk assessment - Monitoring during implementation of remedial action	- Site character. - Risk assessment - Evaluation of alternatives - Engineering design of remedial action - Monitoring during implementation of remedial action
Analytical Levels[1, 2]	I, III, IV	III, IV	III, IV	I, III, IV	I, III, IV	II, IV	I, IV

[1]Analytical descriptions per EPA (modified):

I: Field screening or analysis using portable instruments;
II. Field analyses using sophisticated portable analytical instruments; may be in a mobile laboratory on site;
III. All analyses performed in an off-site analytical laboratory. The laboratory may or may not be in Contract Laboratory Program (CLP);
IV. All analyses are preformed in an off-site analytical laboratory following CLP protocols.

[2]Any non-CLP parameters will be analyzed at a level consistent with the CLP QC guidelines. CLP-equivalent data packages will be provided by the analytical laboratory.

[3]Contaminants of Concern: VOC: Volatile Organic Compounds SVOC: Semivolatile Organic Compounds; Pest/PCBs: Organochlorine pesticides/PCBs; PPM: Priority Pollutant Metals; Radionuclides: Gross Alpha-Beta, Gross Gamma; MFS: Minimum Functional Standards.

[4]VOCs under investigation are chloroform, 1,1-DCA, 1,1-DCE, Trans-1,2-DCE, 1,1,1-TCA, PCE, TCE, and Toluene.

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Table 12, Continued

DATA QUALITY OBJECTIVES SUMMARY

PASCO LANDFILL
PASCO, WASHINGTON

Activity	SOIL			GROUNDWATER		AIR	
	Background Sample	Surface Sample	Subsurface Sample	Background Sample	Well Sample	Soil-Gas Sample	Landfill Gas Sample
Contamination of Concern[3]	1. Pest/PCBs 2. Herbicides 3. PPM 4. Radionuclides	1. SVOC 2. Pest/PCBs 3. Herbicides 4. PPM 5. Radionuclides	1. VOC 2. SVOC 3. Pest/PCBs 4. Herbicides 5. Dioxin 6. PPM 7. Radionuclides	1. MFS 2. VOC 3. SVOC 4. Pest/PCBs 5. Herbicides 6. PPM 7. Radionuclides	Same as Background	1. VOC[4]	1. Methane 2. Oxygen 3. Nitrogen 4. Hydrogen 5. Carbon dioxide 6. Hydrogen sulfide 7. VOC 8. Gas pressure
Level of Concern	mg/kg - ug/kg ppm - ppb	ug/kg ppb	ug/kg ppb	mg/L - ug/L ppm - ppb	ug/L ppb	mg/L ppm	mg/L - ug/L ppm - ppb
Critical Samples	Critical samples are all samples analyzed using Level IV protocols						

[1]Analytical descriptions per EPA (modified):

I: Field screening or analysis using portable instruments;
II. Field analyses using sophisticated portable analytical instruments; may be in a mobile laboratory on site;
III. All analyses performed in an off-site analytical laboratory. The laboratory may or may not be in Contract Laboratory Program (CLP);
IV. All analyses are preformed in an off-site analytical laboratory following CLP protocols.

[2]Any non-CLP parameters will be analyzed at a level consistent with the CLP QC guidelines. CLP-equivalent data packages will be provided by the analytical laboratory.

[3]Contaminants of Concern: VOC: Volatile Organic Compounds SVOC: Semivolatile Organic Compounds; Pest/PCBs: Organochlorine pesticides/PCBs; PPM: Priority Pollutant Metals; Radionuclides: Gross Alpha-Beta, Gross Gamma; MFS: Minimum Functional Standards.

[4]VOCs under investigation are chloroform, 1,1-DCA, 1,1-DCE, Trans-1,2-DCE, 1,1,1-TCA, PCE, TCE, and Toluene.

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Further details are provided in Section 4 of the Quality Assurance Project Plan (QAPP) (Volume II, Part 2). Completion of the RI activities listed on Table 11 begins with the sampling and screening or analysis summarized on Table 12. These data will be incorporated with the existing PCSM and the information gathered through the various geophysical, geologic, hydrogeologic, and Preliminary Risk Assessment tasks described in Section 5 of this Work Plan (Volume I) to complete the RI activities listed on Table 11.

5 PHASE I REMEDIAL INVESTIGATION TASKS

The specific Phase I RI activities that the Pasco Landfill PLP group will conduct are segregated into the following seven tasks:

- Task 1 - Project Planning;
- Task 2 - Community Relations;
- Task 3 - Site History Evaluation;
- Task 4 - Field Investigations;
- Task 5 - Sample Analysis/Validation;
- Task 6 - Data Evaluation;
- Task 7 - Preliminary Risk Assessment;
- Task 8 - Preliminary MTCA Cleanup Level Calculations;
- Task 9 - Interim Action Evaluation; and
- Task 10 - Reporting.

5.1 Task 1 - Project Planning

Project planning began with an initial evaluation of the available data and negotiations between numerous PLPs and Ecology. An Agreed Order was signed by the PLP Group members and Ecology in June and July 1992 and became effective on August 5, 1992. The Order included a Work Scope that summarized the elements of this investigation. The Work Scope became the basis for this Work Plan and the accompanying planning documents.

Project planning is considered an iterative function that will require periodic review of the information and data available to assess whether a change in scope or procedure is appropriate. Ecology will be informed of all significant proposed scope changes and will be involved in the decision making process.

The Pasco Landfill Phase I RI follows the MTCA regulations (Chapter 173-340 WAC) and is consistent with the methodology described in the USEPA Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (USEPA 540/G-89/004, 1988e) and Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites (USEPA 540/P-91/001).

5.2 Task 2 - Community Relations

A Public Participation Plan (PPP) (Volume V) was developed for this project and is provided under separate cover. This plan is designed to continue and expand upon the public participation activities previously started by Ecology. The PPP is designed to provide two-way communication between the PLP Group, Ecology, and interested parties. Means of communication, including fact sheets and public meetings or open houses, are outlined in the PPP.

5.3 Task 3 - Site History Evaluation

Additional information on site history will be collected under this task. Specific subtasks will include the following:

- evaluation of all aerial photographs currently present in the Administrative Record and any aerial photographs supplied by PLPs or their consultants;

- file reviews (including past permits and correspondence) to further clarify the following issues:

  - varieties, quantities, locations, and timing of materials disposed, with particular attention to disposal practices between 1974 and 1981;

  - documentation of operation and closure practices, permit requirements and administrative processes for the potential source areas; and

  - previous study findings;

- additional interviews with knowledgeable persons, potentially including Mr. John Dietrich, Mr. Larry Dietrich, Basin Disposal Inc. employees and specific personnel within the Washington Department of Ecology and Franklin County Health Department. These interviews will be supported by the aerial photographs and file review findings; and

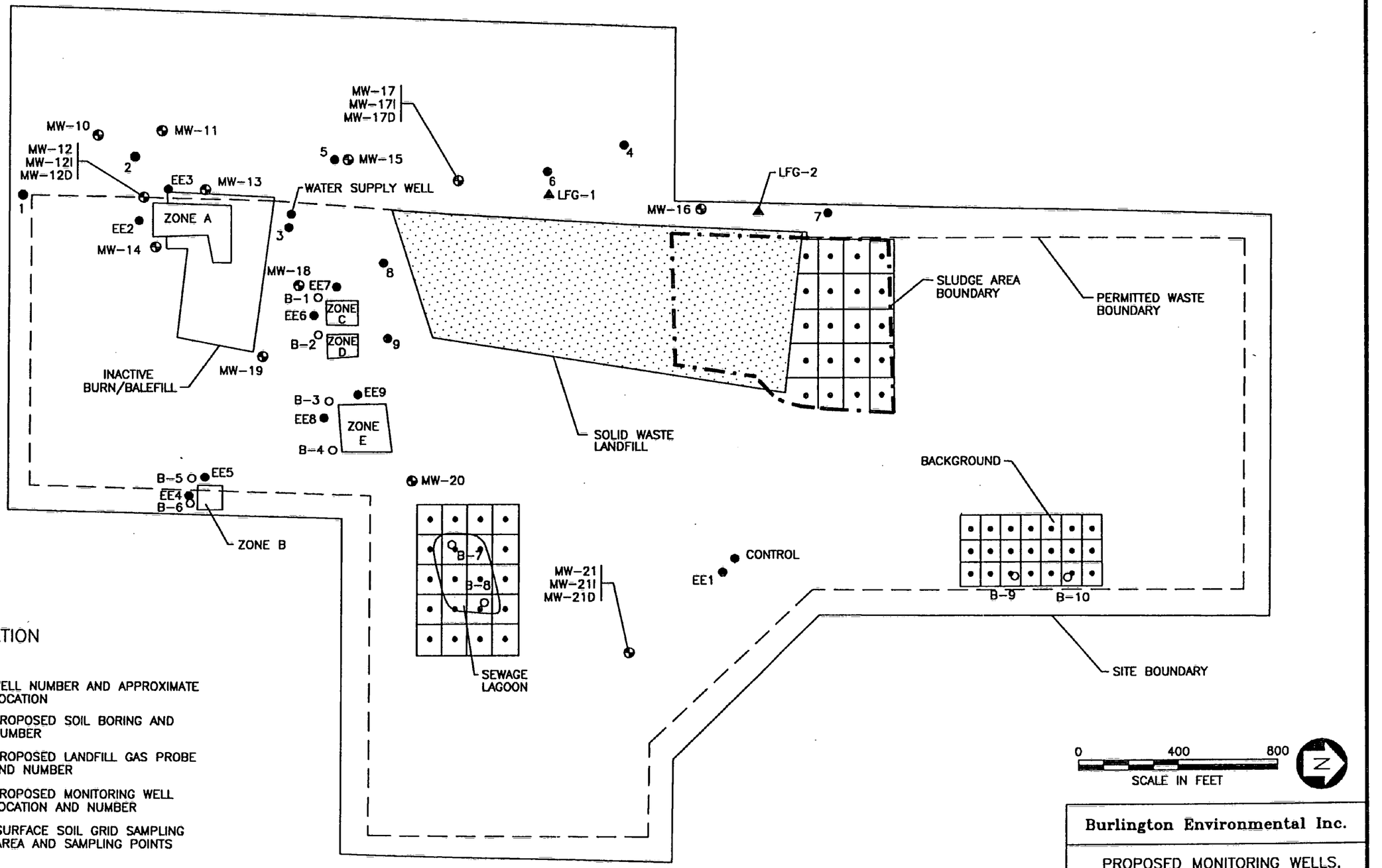
- the findings from the subtasks above will be assembled, evaluated in conjunction with the current information on the site history and the information obtained through the remaining Phase I RI, and summarized in the Phase I RI report (see Section 5.10.2). References to all sources of information will be provided.

5.4 Task 4 - Field Investigations

A Sampling and Analysis Plan (SAP) (Volume II) was developed for this project and is comprised of a Field Sampling Plan (FSP) (Part 1), QAPP (Part 2), and Investigative Waste Management Plan (IWMP) (Part 3). The SAP and HASP pertain to the field investigation. Figures 6 and 7 show the general locations of the various field investigation activities.

	DRAWN BY	CHECKED BY	DOCUMENT MANAGER	PROJECT MANAGER
A	BG 10/15/92	10/15/92	JC 10/29/92	10/29/92

REV. DATE 10/14/92



EXPLANATION

● EE2	WELL NUMBER AND APPROXIMATE LOCATION
○ B-3	PROPOSED SOIL BORING AND NUMBER
▲ LFG-1	PROPOSED LANDFILL GAS PROBE AND NUMBER
⊕ MW-10	PROPOSED MONITORING WELL LOCATION AND NUMBER
• •	SURFACE SOIL GRID SAMPLING AREA AND SAMPLING POINTS

0 400 800

SCALE IN FEET

N

Burlington Environmental Inc.

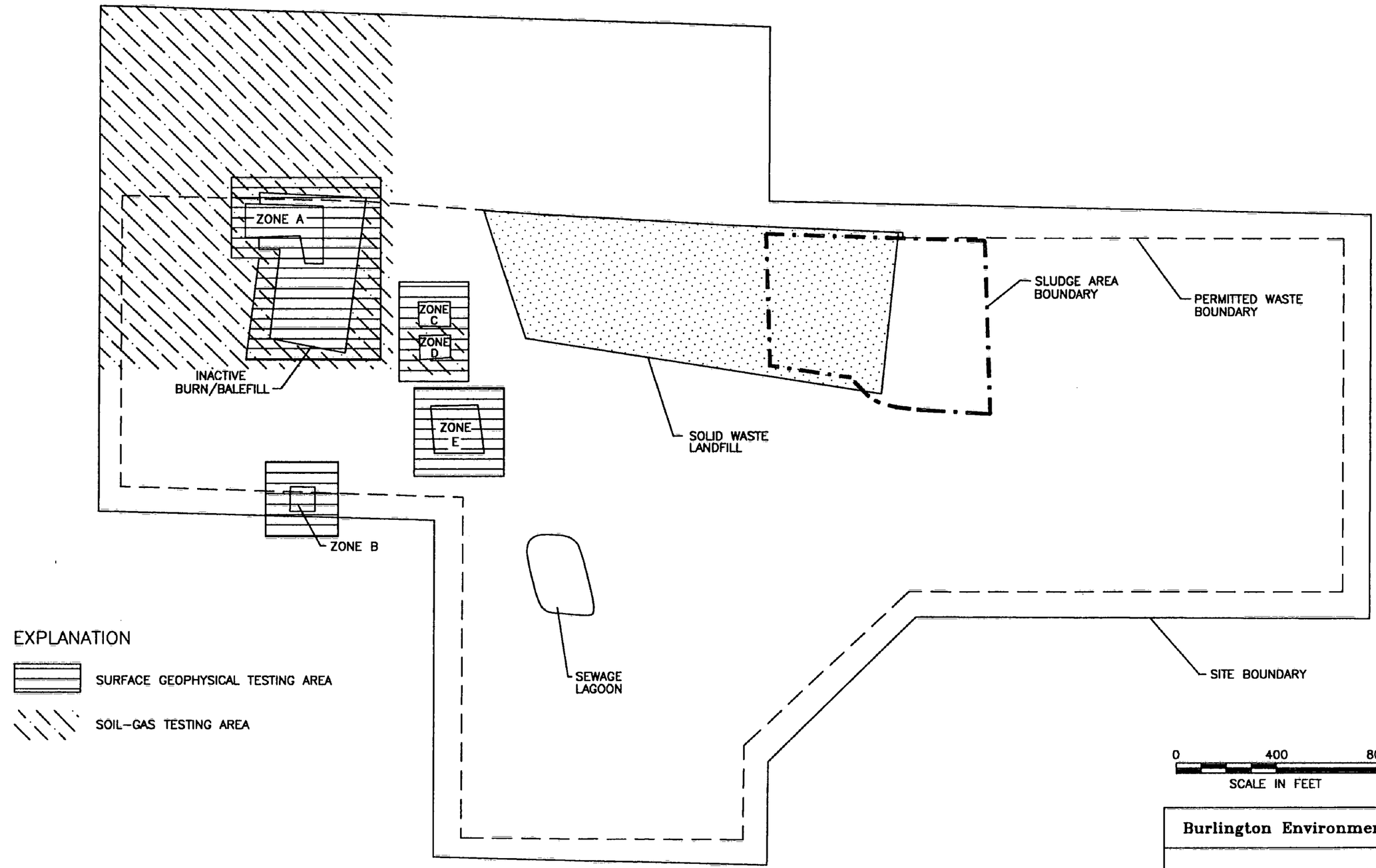
PROPOSED MONITORING WELLS, BORINGS, AND SURFACE SOIL TESTING AREAS

PASCO LANDFILL
PASCO, WASHINGTON
624419

FIGURE 6

	DRAWN BY	CHECKED BY	DOCUMENT MANAGER	PROJECT MANAGER
A	BS 10/21/92		JHW 10/21/92	JW 10/22/92

REV. DATE 10/20/92



Burlington Environmental Inc.

PROPOSED SURFACE GEOPHYSICAL AND SOIL-GAS TESTING AREAS

PASCO LANDFILL
PASCO, WASHINGTON
624419

FIGURE 7

Detailed descriptions of the following field investigation activities are provided in the documents listed above:

- objectives of sampling program;
- sample types;
- sample locations;
- sampling methods;
- sample handling and tracking;
- number of samples to be screened and/or analyzed;
- proposed field screening and laboratory analyses;
- geologic test drilling;
- geologic logging;
- geophysical testing;
- soil-gas testing;
- landfill gas testing;
- proposed monitoring well, soil-gas, landfill gas, and geophysical testing locations;
- monitoring well development;
- field equipment decontamination; and
- investigative waste management.

5.5 Task 5 - Sample Analysis/Validation

The Pasco Landfill Phase I RI QAPP describes the quality control (QC) procedures that Burlington will implement for this investigation. The objective of QC is to provide data that can be used to evaluate the nature and extent of contaminants remaining in on-site soil and groundwater and that is quantitatively and qualitatively accurate and reliable. Documentation is required for sample and record control; data transmission, reduction, and transcription; and related activities.

The QAPP provides detailed descriptions of sample analysis/validation procedures including:

- sample identification and labelling;
- field documentation;
- chain-of-custody record;
- custody seals;
- chemical analysis request form;
- sample delivery to the laboratory; and
- field and laboratory quality control.

All analytical results will be reviewed by the Burlington Laboratory Coordinator. Items reviewed in detail will include holding times, chromatograms, surrogate recoveries, instrument calibrations, and tests performed. Questionable results will be discussed with the laboratory personnel. Results will be reviewed and compared to USEPA Contract Laboratory Program (CLP) guidelines as specified in the QAPP. A summary of the assurance review will then be produced and will become part of the Phase I RI report.

5.6 Task 6 - Data Evaluation

During the Phase I RI fieldwork, the existing monitoring well network will be evaluated for surface seal and surface protection integrity, sampling system condition, and the ability to produce water of acceptable characteristics for ensuring valid analytical results. Wells will be sampled and water elevations measured. These data will be reviewed in conjunction with the historical groundwater elevation and quality data to determine the applicability of the historical data to this Phase I RI effort. Parameters to be considered in this evaluation include:

- groundwater elevations versus screen elevations;
- double screen well data versus single screen well data; and
- well construction and subsurface conditions such as single-cased wells drilled through refuse.

Burlington will analyze all site investigation data and present the results in an organized and logical manner so that the relationships between site investigation results for each medium are apparent. This evaluation and the related text in the Phase I RI Report will also include a discussion of previous groundwater and landfill gas monitoring results, hydrographs of available water levels, and documentation of the present status of existing environmental controls present at the site. This evaluation and the overall site characterization will be presented along with the supporting back-up in the Phase I RI Report.

5.7 Task 7 - Preliminary Risk Assessment

The focus of the PRA will be an evaluation of the plausibility of the potential exposure pathways. Background information on the environmental setting such as the human population distribution, local sensitive habitats, and regional groundwater uses was evaluated in developing

the PRA scope outlined below. The results of the PRA will be included as a separate chapter of the Phase I RI report. In the future, the PRA may be used to develop a baseline human health risk assessment in compliance with the NCP.

Since the cleanup actions are to be conducted under the authority of MTCA, the PRA will be prepared in accordance with the regulations promulgated under this act. The site is on the NPL and the PRA will also be consistent with the NCP. The PRA will be prepared using applicable protocols detailed in the various USEPA CERCLA risk assessment guidance materials including USEPA Region 10's Supplemental Risk Assessment Guidance for Superfund (USEPA, 1991b). The principal USEPA guidance documents that will be followed are listed in the reference section of this Work Plan. Additional references may include USEPA's Integrated Risk Information System (IRIS) database supplemented by toxicological profiles prepared by ATSDR.

The primary objective of the PRA is to furnish an independent evaluation of the health risks and potential ecological impacts associated with the site. The human health evaluation will characterize the potential health risks posed by exposure to chemical compounds of concern detected in environmental media. The ecological evaluation will identify the potential ecological impacts associated with selected compounds of concern. In combination, these evaluations will provide a preliminary understanding of potential impacts and will be used, in part, to determine additional data needs. The PRA will also provide direction for the FS to select appropriate remedial alternatives such that health and environmental risks are reduced to acceptable levels.

5.7.1 Preliminary Risk Assessment Process

The two components of the PRA are identification of chemicals of concern and exposure assessment. A discussion of each of these components follows. As stated previously, the PRA will include a discussion of the sources of uncertainty in the analysis and identify remaining data gaps.

5.7.1.1 Chemicals of Concern Identification

Because of the large number of chemicals typically detected at a site, it is usually necessary to select a manageable subset. The chemicals selected, called chemicals of concern, or indicator hazardous substances, are chosen to represent the more toxic, mobile, and persistent chemicals detected at a site, as well as those present at the highest concentrations. The regulatory framework cited in WAC 173-340-708(2) will be used as a basis for selection of the chemicals of concern if a large number of hazardous substances are detected at the site. The primary purpose of this exercise is to eliminate from consideration those hazardous substances that contribute a relatively small percentage of the overall threat to human health and the environment. Cleanup levels will be defined for the indicator hazardous substances. An important step in the selection of chemicals of concern is to compare the concentrations of chemicals measured on site to local background concentrations and published regional values. The assumption is made that a chemical is not an indicator of site-related impacts if it is not present at concentrations statistically above background. To be eliminated from the list of chemicals of concern, compounds must meet one of two criteria: they must have been detected in an insignificant number of samples, or their observed concentrations must have been well below either promulgated or calculated health-based limits.

A preliminary list of the potential chemicals of concern at the site appears in Table 3. This list may be revised based on the results of the Phase I RI data evaluation.

5.7.1.2 Exposure Assessment

As part of the PRA, known or hypothetical exposure pathways associated with the identified receptors will be assessed. The pathways evaluated in the exposure assessment will consider potential releases from the site into soil, air, groundwater, and surface water. In

accordance with WAC 173-340-708(3), cleanup levels will be based on estimates of current and future resource uses and reasonable maximum exposure expected to occur under both current and potential future site use conditions. Exposure pathways will be evaluated for completeness, plausibility, and importance relative to public health and ecological impacts. For an actual exposure to occur or a potential exposure to be viable, the exposure pathway must be complete: there must be a source of a hazardous chemical, a mechanism of its transport and dispersion into the environment to the receptors, and a human or ecological receptor.

5.8 Task 8 - Preliminary MTCA Cleanup Level Calculations

Based on Preliminary Risk Assessment results, preliminary cleanup levels will be provided in accordance with the procedures defined in MTCA (WAC 173-340) for developing cleanup levels. Cleanup levels will be evaluated for contaminants of concern based on reasonable maximum exposures expected to occur under both current and future site uses. This task will include the following efforts:

1. MTCA risk-based formula values available in tables provided by Ecology will be compiled.

2. The most recent toxicity values available in the USEPA IRIS database and the USEPA Health Effects Assessment Summary Tables will be reviewed to determine if the MTCA risk-based formula values must be updated based on new toxicity data.

3. Risk-based cleanup levels will be calculated for those chemicals not available in the risk-based formula tables.

4. If necessary, risk-based formula values will be adjusted downward to account for multiple chemicals and multiple exposure pathways.

The preliminary cleanup levels identified through this process will be presented as a section of the Phase I RI report.

5.9 Task 9 - Interim Action Evaluation

Based on the site characterization findings, the applicability of interim actions will be assessed, per WAC 173-340-430. This assessment and the determinations made will be provided in the Phase I RI report. If the interim actions are found to be warranted, the PLP Group will work with Ecology to initiate the actions.

5.10 Task 10 - Reporting

Reporting during the Phase I RI will include monthly reports and draft and final RI reports.

5.10.1 Monthly Reports to Ecology

Burlington will prepare monthly reports that describe the progress of the Phase I RI. As specified in the Agreed Order, the reports will include an estimate of percent complete for each task or subtask identified in the scope of work, address progress made during the period, work in progress, problem areas, key activities and scheduling, deliverables submitted, field work and data generated, subcontracting, analytical services performed, and key staff changes. These reports will be provided by the 15th day of each month and will cover activities completed or underway the previous month.

5.10.2 Draft and Final Phase I RI Reports

A Phase I Remedial Investigation Report will be produced when all data from the field investigation have been received and evaluated. A preliminary draft report will be submitted to the Pasco Landfill PLP Group. After comments are received from the PLP members, they will be incorporated into a Draft Phase I Remedial Investigation Report that will be submitted to Ecology. Comments from Ecology will be incorporated into the final report.

The Phase I RI Report will provide a summary of the characterization data collected, the results of the data evaluation and preliminary risk assessment, and back-up analytical and field data. The conceptual site model presented in this Work Plan will be revised in the Phase I RI report as needed based on the information collected through the Phase I RI. Supporting materials will include:

- geologic logs;
- geophysical testing result summaries and backup including:
  - tabulated raw data;
  - any algorithm used to define anomalous responses; and
  - appropriate field method descriptions;
- well completion diagrams and reports;
- site location and base maps;
- sampling location maps;
- groundwater elevation maps;
- soil-gas concentration contour map; and
- analytical results and summary tables.

In addition to the Phase I RI report, groundwater data will be presented to Ecology in a magnetic media format (diskette) in conformance with the procedures outlined in the Ecology Cleanup Information Memorandum No. 91-1, dated July 12, 1991.

6 SCHEDULE

The effective date of the Agreed Order is August 5, 1992. The Agreed Order stipulates that the schedule below will be followed:

1. Within 30 days of the effective date of the Agreed Order, the PLP Group shall submit to Ecology a proposed work plan. Submittal of this Phase I RI Work Plan constitutes completion of this item.

2. Within 45 days after receipt of the Work Plan, Ecology shall notify the PLP Group, in writing, of Ecology's approval or disapproval of the Work Plan. In the event of any disapproval, Ecology shall specify, in writing, both the deficiencies and any Ecology-recommended modifications regarding the Work Plan.

3. Within 15 days of the receipt of Ecology's notification of the Work Plan disapproval or recommended modification, the PLP Group shall amend and submit to Ecology a revised Work Plan incorporating the modifications required by Ecology.

4. Within 15 days of the final approval of the Work Plan, the PLP Group shall commence work.

5. Progress reports shall be completed on a monthly basis.

The field work, analysis, data validation, and report development tasks are expected to follow the schedule below:

1. Field work duration will be approximately 13 weeks.

2. Laboratory sample analysis will begin approximately six weeks after field work start-up, and will be completed approximately six weeks after field work completion.

3. Data validation will begin shortly after receipt of the first portions of the analytical reports and will continue approximately eight weeks after receipt of the last analytical reports are received.

4. Draft Phase I RI report development will begin approximately four weeks after data validation has begun and will be completed approximately 16 weeks after the data validation task is complete.

5. The draft Phase I RI Report will be provided to Ecology immediately after completion.

6. The final Phase I RI Report will be provided to Ecology within 6 weeks of receipt of Ecology's comments on the draft Phase I RI Report.

7 KEY PROJECT PERSONNEL AND COORDINATION

The following organizations and individuals have key roles in this project.

Washington Department of Ecology

Project Coordinator	Guy J. Gregory

PLP Group

Project Coordinator	Marlys S. Palumbo

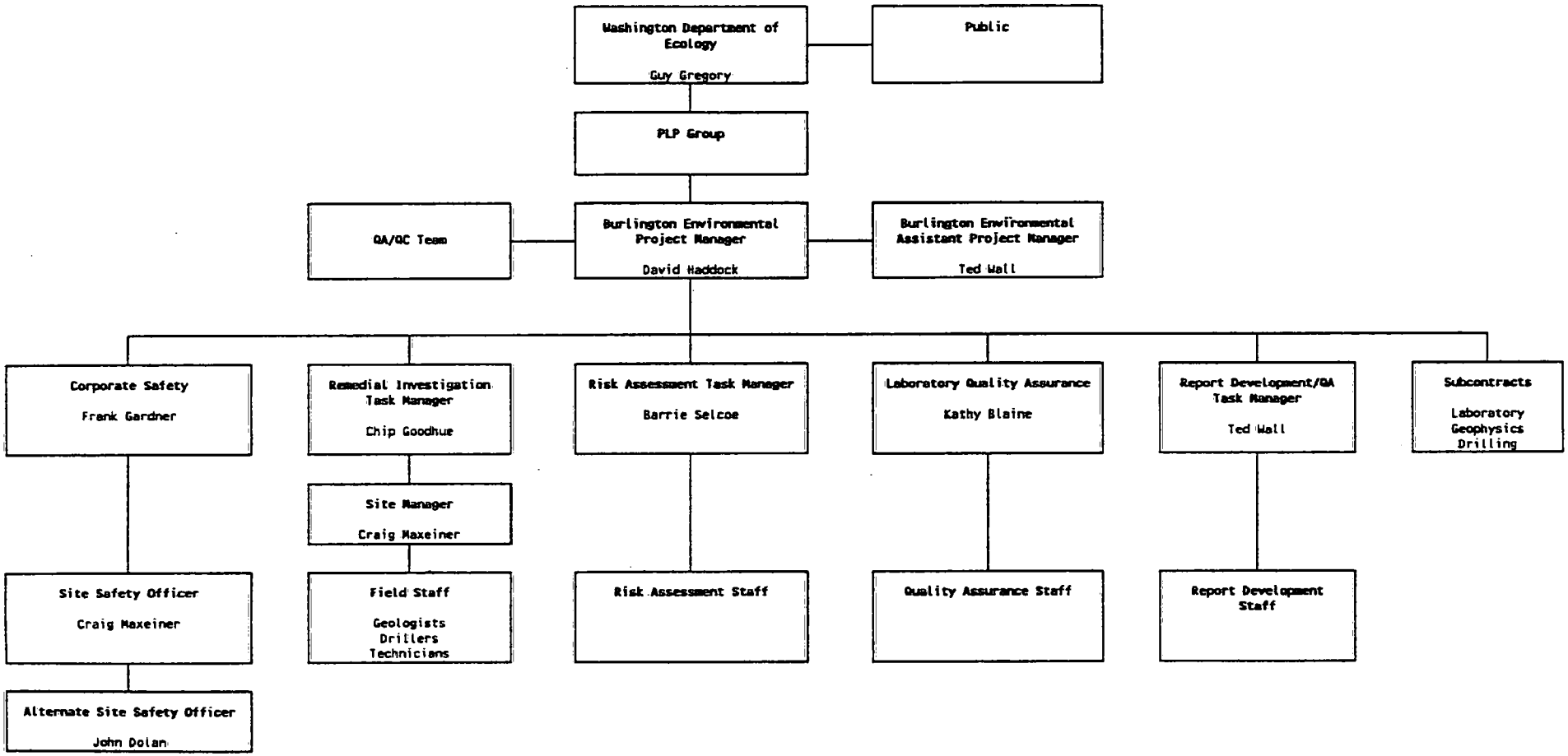
Burlington Environmental Inc.

Project Manager	David R. Haddock
Assistant Project Manager	Ted J. Wall
Remedial Investigation Task Manager	William (Chip) V. Goodhue
Site Manager	Craig M. Maxeiner
Alternate Site Manager	William (Chip) V. Goodhue
Corporate Safety Officer	Frank Gardner
Site Safety Officer	Craig M. Maxeiner
Alternate Site Safety Officer	John W. Dolan
Quality Assurance Officer	Kathy A. Blaine
Risk Assessment Task Manager	Barrie Selcoe

Figure 8 outlines the project structure and lines of communication.

Figure 8

PHASE I REMEDIAL INVESTIGATION ORGANIZATIONAL CHART
PASCO LANDFILL
PASCO, WASHINGTON



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LIST OF ACRONYMS

ACL	Alternate Concentration Limit
ARAR	Applicable or Relevant and Appropriate Requirements
ATSDR	Agency for Toxic Substances and Disease Registry
BLM	U.S. Bureau of Land Management
BNRR	Burlington Northern Railroad
Burlington	Burlington Environmental Incorporated
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CLP	Contract Laboratory Program
COPC	Chemical of Potential Concern
DMP	Data Management Plan
DQO	Data Quality Objective
Ecology	Washington Department of Ecology
E&E	Ecology and Environment, Inc.
FR	Federal Register
FSP	Field Sampling Plan
HA	Health Assessment
HASP	Health and Safety Plan
IRIS	Integrated Risk Information System
IWMP	Investigative Waste Management Plan
LOAEL	Lowest-Observed-Adverse-Effect-Level
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goals
MTCA	Model Toxics Control Act
NCP	National Contingency Plan
NGVD	National Geodetic Vertical Datum
NOAEL	No-Observed-Adverse-Effect-Level
NOEL	No-Observed-Effect-Level

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LIST OF ACRONYMS, Continued

NPL	National Priority List
NWI	National Wetlands Inventory
PCSM	Preliminary Conceptual Site Model
PLP	Potential Liable Party
PPP	Public Participation Plan
PRA	Preliminary Risk Assessment
PSL	Pasco Sanitary Landfill
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
RRC	Resource Recovery Corporation
SAP	Sampling and Analysis Plan
SITE	Superfund Innovative Technology Evaluation Program
TRIDEC	Tri-City Industrial Development Council
USEPA	U.S. Environmental Protection agency
VOC	Volatile Organic Compound
WAC	Washington Administrative Code
WDNR	Washington State Department of National Resources
WDW	Washington State Department of Wildlife

APPENDIX
A

APPENDIX A

Correspondence Regarding Threatened or Endangered Species

WASHINGTON STATE DEPARTMENT OF
Natural Resources

BRIAN BOYLE
Commissioner of Public Lands

OLYMPIA, WA 98504

June 29, 1992

Mattie Leuschen
Burlington Environmental Inc
7440 West Marginal Way South
Seattle WA 98108

SUBJECT: Remedial Investigation of the Pasco Landfill
T09N R30E S15 & S22

We've searched the Natural Heritage Information System for information on significant natural features in your study area. Currently, we have no records for rare plants, high quality native wetlands or high quality native plant communities in the vicinity of your project. Although we cannot confirm the presence of rare plants within the defined area, neither can we confirm their absence.

The Natural Heritage Information System is a cooperative effort between the Department of Natural Resources' Washington Natural Heritage Program and the Department of Wildlife's Nongame Program. The Washington Natural Heritage Program is responsible for information on the state's endangered, threatened, and sensitive plants as well as high quality native plant communities and wetlands. The Nongame Program manages and interprets data on wildlife species of concern in the state. For information on animals of concern in the state, please contact the Nongame Program, Washington Department of Wildlife, 600 Capitol Way North, Olympia, WA 98501-1091.

The Natural Heritage Information System is not a complete inventory of Washington's natural features. Many areas of the state have never been thoroughly surveyed. There may be significant natural features in your study area that we don't yet know about. This response should not be regarded as a final statement on the natural features of the areas being considered and doesn't eliminate the need or responsibility for detailed on-site surveys.

I hope you'll find this information helpful.

Sincerely,

Sandy Norwood

Sandy Norwood, Environmental Review Coordinator
Washington Natural Heritage Program
Division of Land & Water Conservation
PO Box 47047
Olympia, WA 98504-7047
(206) 753-2449

CURT SMITCH
Director

STATE OF WASHINGTON
DEPARTMENT OF WILDLIFE
600 Capitol Way North • Olympia, Washington 98501-1091 • (206) 753-5700

Mattie Leuschen
Burlington Environmental, Inc.
7440 W. Marginal Way South
Seattle Wa. 98108

Dear Ms. Leuschen

In response to your data request of June 12, 1992, there was some confusion about the information you needed. We had some trouble with our Washington Rivers Information System Database, so I was holding this project until we resolved the problem. But after talking with Leah Knutsen on 7/10/92 we concluded the best source of information for wetland and riparian zones would be the USFWS's National Wetlands Inventory which the Wa. State Dept. of Ecology maintains. The DOE contact will be Joan Velikanje (206)459 - 6202.

After reviewing the material within our Priority Habitat and Species database (PHS), I have found no areas assigned as priority habitat at this time. However, this may be due to the fact that this area is schedualed to be surveyed this summer and fall and we haven't recieved this information yet. The best way to find out if this area is presently being considered for a priority habitat designation is to contact Tracy Lloyd, the Region 2 area Biologist, at our Ephrata office ((509) 456-4082).

Sincerely

John Talmadge
Cartographer

JT:jt
cc: ~~John Andrews~~

CURT SMITCH
Director

STATE OF WASHINGTON
DEPARTMENT OF WILDLIFE
1540 Alder St. N.W., Ephrata, WA 98823 Tel. (509) 754-4624

July 28, 1992

Mattie Lauschan
Burlington Environmental Inc.
7440 West Marginal Way South
Seattle, WA 98108

Dear Ms. Leuschen:

Subject: Priority Habitat Designation - Pasco Landfill

As we discussed on the telephone last week, I was able to visit the landfill site today to evaluate the wildlife habitat. Following is a description of my observations:

The Pasco landfill site is almost entirely surrounded by agricultural fields primarily irrigated alfalfa. Within the area of the landfill, the vegetation is severely impacted by past activities including management of the landfill, grazing and probably fires. There is little occurrence of native plants on the site. Some Sandberg's bluegrass and Indian ricegrass were found. The only shrub on the site was gray rabbit brush. The majority of the vegetation is composed of annual grasses and weeds including cheat grass, tumble mustard, Russian thistle and species of knapweed.

The area represents poor quality wildlife habitat. There could be 2-3 pairs burrowing owls, 1-2 pairs of long-billed curlews and a small population of ring-necked pheasants associated with the area. Although, no individuals of these species were observed on this date. It is doubtful any Washington ground squirrels use the site due to the low quality of habitat. There likely is a small rodent population associated with the site especially along the borders adjacent to the irrigated fields. The rodents would provide a prey base to the owls and to 3-4 species of raptors that likely use the area as winter habitat. These would include rough-legged hawks, red-tailed hawks, northern harriers and American kestrels.

The site will likely continue to provide habitat for this community of wildlife as long as some open space is provided. The quality of habitat could be improved as areas

of the landfill are restored to a permanent cover of grasses and possible some shrubs. The Soil Conservation Services could recommend plant species for the soil type and rainfall of the area. Artificial burrows would make the area more attractive for the burrowing owls.

I hope this information is helpful and meets your needs. Please feel to call if you have more questions (509) 754-4624.

Sincerely,

Ron Friesz
Habitat Biologist

cc: Tracy Lloyd

CURT SMITH
Director

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To Mattie Leuschen	From Patty
Co. Burlington Environ	Co. WDW/NGDS
Dept.	Phone # 586 1449
Fax # 747 3060	Fax # 493 9497

STATE OF WAS

DEPARTMENT (

600 Capitol Way North • Olympia, Washington 98501-1091 • (206) 753-5700

Mattie Leuschen
BURLINGTON ENVIRONMENTAL INC.
7440 West Marginal Way South
Seattle, WA 98108

RE: DATA SEARCH - PASCO LANDFILL

Dear Ms. Leuschen:

We have completed a review of our files for information on nongame species of concern in the study area. The result of this review is presented in the enclosed material, which summarizes the occurrence of special animals reported within or adjacent to the study area.

We hope this presentation will be useful to you. This response is provided for your information only and is not to be construed as an official Department of Wildlife environmental review of your project. For official Department review and comment, mail environmental impact documents to: Washington Department of Wildlife, Tracy Lloyd, Regional Habitat Program Manager, P.O. Box 850, Ephrata, WA 98823-9699.

If your office should publish or distribute general information from the enclosed material, please provide the Nongame Wildlife Program with a draft of any document in which information from the Natural Heritage Data System is incorporated or referenced, and cite the System as follows:

Natural Heritage Data System
Department of Wildlife · Nongame Program
600 Capitol Way N
Olympia, Washington 98501-1091

The information provided is not to be taken as a complete inventory of the project area and does not eliminate the need or responsibility to conduct more thorough research. If you have further questions or concerns, please feel free to contact us at (206) 586-1449.

Sincerely,

Carmen Andonaegui, Biologist
Nongame Data Systems

Enclosure

cc: Ron Friesz
Tracy Lloyd

ENCLOSURE 1

ELEMENT OCCURRENCE SUMMARY

INTRODUCTION

The Natural Heritage Data System was established by the State of Washington and the Washington Natural Heritage Program of the Nature Conservancy. It is currently maintained by the Heritage Program of the Washington Department of Natural Resources and by the Nongame Wildlife Program of the Washington Department of Wildlife.

The database is comprised of "element occurrences." An "element" is a natural feature of particular interest because it is exemplary, unique, or endangered on a statewide or national basis. An element can be a plant community, special plant, or special animal species. An "element occurrence" is a reported or confirmed locality of a native vegetation community, or of significant habitat for a plant or animal species of concern. Information on element occurrences in the state is collected from herbarium and museum specimens, scientific literature, knowledgeable individuals, and field investigations. This information is compiled in the Natural Heritage Data System for use in land-use planning and evaluating the status of Washington's natural features.

This enclosure summarizes the special animal occurrences recorded within the system. The Washington Natural Heritage Program manages similar information concerning special plants and plant communities.

FORMAT

The Element Occurrence Summary table lists those special animals that have been reported to occur in or adjacent to the area specified in your information request.

- The first column lists the U.S. Geological Service (USGS) topographic quadrangle.
- The second column lists the township, range, and section.
- The third column, entitled "conf." (confirmation), lists a code indicating the specificity of the locations recorded for each element occurrence.

CONFIRMATION CODES

C = The location of the element occurrence is known to within a 1/4-mile radius. In addition, the locality has been confirmed.

U = The location of the element occurrence is known to within a 1/4-mile radius, but at this time has not been confirmed.

N = The location of the element occurrence is known to within a 1-mile radius. This information usually is derived from secondary sources.

G = The element occurrence is known only to a general area, usually denoted by a geographic name. This information was derived from secondary sources.

- The next column contains federal and state status information.

STATUS CODES FOR SPECIAL ANIMALS

CODE	EXPLANATION
FE	FEDERAL ENDANGERED - A species in danger of extinction throughout all or a significant portion of its range.
FT	FEDERAL THREATENED - A species which is likely to become endangered within the foreseeable future.
FC1	FEDERAL CANDIDATE CATEGORY 1 - A species that is a candidate for listing under the Endangered Species Act. U.S. Fish and Wildlife Service has substantial evidence to support listing as threatened and endangered species.
FC2	FEDERAL CANDIDATE CATEGORY 2 - A species that is a candidate for listing under the Endangered Species Act. Listing is possibly appropriate but conclusive information is lacking.
FC3	FEDERAL CANDIDATE CATEGORY 3 - A species that was once considered for listing under the Endangered Species Act which is no longer being considered.
FS	FEDERAL SENSITIVE - A species that is informally considered a sensitive species by the U.S. Fish and Wildlife Service, Region One.

The state status given in the second column under "Element Status" is based on status evaluations conducted by the Washington Department of Wildlife, Nongame Program.

CODE	EXPLANATION
SE	STATE ENDANGERED - Wildlife species native to the state of Washington that are seriously threatened with extinction throughout all or a significant proportion of their ranges within the state. Endangered species are legally designated in WAC 232-12-014.
	Washington that are likely to become endangered within the foreseeable future throughout significant portions of their ranges within the state without cooperative management or the removal of threats. Threatened species are legally designated in WAC 232-12-011.
SS	STATE SENSITIVE - Wildlife species native to the state of Washington that are vulnerable or declining and are likely to become endangered or threatened in a significant portion of their ranges within the state without cooperative management or the removal of threats. Sensitive species are legally designated in WAC 232-12-011.

CODE	EXPLANATION
SC	STATE CANDIDATE - Wildlife species that are under review by the Department for possible listing as endangered, threatened, or sensitive. A species will be considered for State Candidate designation if sufficient scientific evidence suggests that its status may meet criteria defined for endangered, threatened, or sensitive in WAC 232-12-297. Currently listed State Threatened or State Sensitive Species may also be designated as a State Candidate Species if their status is in question. State Candidate Species will be managed by the Department, as needed, to ensure the long-term survival of populations in Washington. They are listed in WDW Policy 4802.
M	STATE MONITOR - Wildlife species native to the State of Washington that: 1) were at one time classified as endangered, threatened, or sensitive; 2) require habitat that has limited availability during some portion of its life cycle; 3) are indicators of environmental quality; 4) require further field investigations to determine population status; 5) have unresolved taxonomy which may bear upon their status classification; 6) may be competing with and impacting other species of concern; or 7) have significant popular appeal. State monitor species will be managed by the department, as needed, to prevent them from becoming endangered, threatened, or sensitive. Species already classified in a category that provides adequate management emphasis, survey work, and data maintenance (e.g., game animals, game birds, furbearers, etc.) will not be designated as State Monitor Species. Monitor species are designated in Wildlife Policy 403.

If code column is blank this species is currently under consideration for classification as either endangered, threatened, sensitive or monitor.

In the fourth column the animal species is named.

RE: SPECIES OF CONCERN - PASCO LANDFILL

Quad Name	T	R	S	Conf.	---Status--- Fed.	State	Element Name	Occ.	Occ
PASCO 7.5 4611921	09N	30E	21	C		SC	Athene cunicularia Burrowing owl	B	♀ 182-
PASCO 7.5 4611921	09N	30E	27	C		SC	Athene cunicularia Burrowing owl	B	♀ 251-